

**SOIL SURVEY OF**  
**Big Horn County Area,**  
**Montana**

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**United States Department of Agriculture**  
**Soil Conservation Service**  
**and**  
**United States Department of the Interior**  
**Bureau of Indian Affairs**  
**In cooperation with**  
**Montana Agricultural Experiment Station**



This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in the period 1962-70. Soil names and descriptions were approved in 1970. Unless otherwise indicated, statements in the publication refer to conditions in the Area in 1971. This survey was made cooperatively by the Soil Conservation Service; the Bureau of Indian Affairs, Missouri River Basin Investigations Project; and the Montana Agricultural Experiment Station. It is part of the technical assistance furnished to the Big Horn Conservation District.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

## HOW TO USE THIS SOIL SURVEY

**T**HIS SOIL SURVEY contains information that can be applied in managing farms, ranches, and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

### Locating Soils

All the soils of the Big Horn Area are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

### Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the Area in alphabetic order by map symbol and shows the dryland and irrigated capability classification of each. It also shows the page where each soil is described and the page for the capability units, range site, and windbreak suitability group in which the soil has been placed.

Individual colored maps that show the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limi-

tation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those that have a moderate limitation can be colored yellow, and those that have a severe limitation can be colored red.

*Farmers and those who work with farmers* can learn about use and management of the soils from the soil descriptions and from the descriptions of the capability units, range sites, and windbreak suitability groups.

*Foresters and others* can refer to the section "Use of the Soils for Windbreaks" and "Use of the Soils for Woodland," where the soils of the Area are grouped according to their suitability for trees.

*Game managers, sportsmen, and others* can find information about soils and wildlife in the section "Use of the Soils for Wildlife."

*Ranchers and others* can find, under "Use of the Soils for Range," groupings of the soils according to their suitability for range and the names of many of the plants that grow on each range site.

*Engineers, builders, community planners, and others* can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

*Scientists and others* can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

*Newcomers in the Big Horn County Area* may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the Area given in the beginning of the publication and in the section "General Nature of the Area."

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**T**HE BIG HORN COUNTY AREA is in the unglaciated, semiarid high plains of extreme south-central Montana (fig. 1). It has an area of 3,042,595 acres, or about 4,754 square miles. The survey area includes all of Big Horn County except the part of the Cheyenne Indian Reservation in the extreme east-central part of the county. Hardin, the county seat, is near the center of the county, about 48 miles southeast of Billings.

General information about the Big Horn County Area can be found in the section "General Nature of the Area" at the back of this survey.

## How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in the Big Horn County Area, where they are located, and how they can be used. The soil scientists went into the Area knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes; the size and speed of streams; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material

that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or geographic feature near the place where a soil of that series was first observed and mapped. Beauvais and Peritsa, for example, are the names of two soil series. All the soils in the United States that have the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Haverson loam, 2 to 4 percent slopes, is one of several phases within the Haverson series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series or of different phases within one series. Three

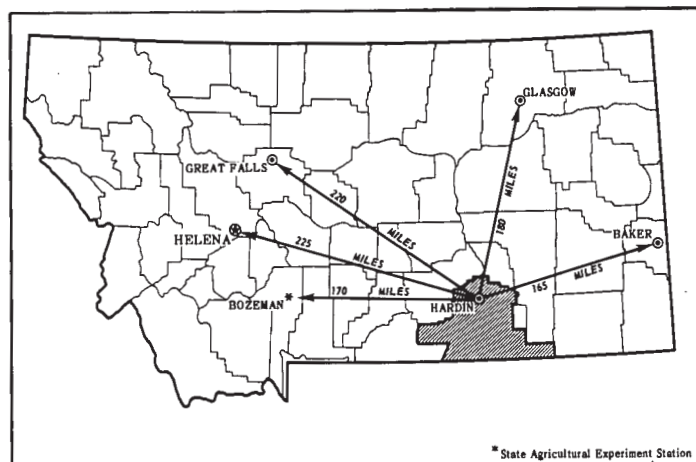


Figure 1.—Location of the Big Horn County Area in Montana.



such kinds of mapping units are shown on the soil map of the Big Horn County Area: soil complexes, soil associations, and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Gilt Edge-Bone complex, 0 to 1 percent slopes, is an example.

A soil association is made up of adjacent soils that occur as areas large enough to be shown individually on the soil map but are shown as one unit because the time and effort of delineating them separately cannot be justified. There is a considerable degree of uniformity in pattern and relative extent of the dominant soils, but the soils may differ greatly one from another. The name of an association consists of the names of the dominant soils, joined by a hyphen. Lap-Armington association, rolling, is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils or of two or more. Haverson and Lohmiller soils, channeled, is an undifferentiated group in this survey area.

In most areas surveyed there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Shale outcrop is a land type in this survey area.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kind of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or a high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil, and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these

groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

## General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in the Big Horn County Area. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map that shows soil associations is useful to people who want a general idea of the soils in an Area, who want to compare different parts of an Area, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The twenty-four soil associations in this survey have been grouped into six general kinds of landscapes for broad interpretative purposes. Each of the broad groups and the soil associations in each group are described in the following pages.

## Soils Dominantly on Stream Terraces and Alluvial Fans

These soils are mainly on stream terraces and alluvial fans. They formed in alluvium. Average annual precipitation ranges from 12 to 17 inches, and the frost-free period is 95 to 125 days. The soils are used mostly for irrigated crops, but some areas are used for dryfarmed crops and range.

Two soil associations in the Big Horn County Area are on stream terraces and alluvial fans.

### 1. Kyle-Lohmiller-Haverson association

*Deep, nearly level to steep, well-drained soils on flood plains, terraces, fans, and foot slopes*

This association consists of mostly nearly level and gently sloping soils on flood plains, terraces, fans, and foot slopes. The soils are steep on the edges of terraces and on streambanks.

This association makes up about 4 percent of the Area. It is about 30 percent Kyle soils, 30 percent Lohmiller soils, 25 percent Haverson soils, and 15 percent other soils. These other soils are in the Glenberg, McRae, Thurlow, Nunn, and Vananda series.



Kyle soils, on fans, foot slopes, and terraces, are nearly level to strongly sloping. The surface layer typically is grayish-brown silty clay about 2 inches thick. The subsoil is olive-gray clay and silty clay. Pale-olive clay is at a depth of 12 inches.

Lohmiller soils, on flood plains, fans, and terraces, are level to steep. The surface layer typically is light brownish-gray silty clay loam about 12 inches thick. It is underlain by light yellowish-brown and pale-olive, stratified silty clay loam and silty clay.

Haverson soils, on low terraces and flood plains, are nearly level to steep. The surface layer typically is grayish-brown loam about 12 inches thick. It is underlain by light yellowish-brown and light brownish-gray, stratified silt loam, loam, and fine sandy loam.

The main concerns of management are localized protection from spring flooding, proper irrigation, control of erosion, and drainage of included wet areas.

The soils in this association are used mostly for irrigated crops, but river islands and low flood plains are used for range, and small areas above irrigation canals are used for dryfarmed crops. Corn, small grain, sugar beets, and hay grow well on all soils in this association, and dry beans grow well on the Haverson and McRae soils. The main farm enterprise is growing crops for cash and for feed for beef cattle.

## 2. *Korchea-Farnuf-Savage association*

*Deep, nearly level to steep, well-drained soils on fans, foot slopes, flood plains, and terraces*

This association consists of mostly nearly level to steep soils on flood plains, terraces, fans, and foot slopes.

This association makes up about 2 percent of the Area. It is about 40 percent Korchea soils, 20 percent Farnuf soils, 20 percent Savage soils, and 20 percent other soils. These soils are in the Shaak, Lennep, and Xavier series.

Korchea soils, on flood plains and fans, are nearly level to steep. The surface layer typically is grayish-brown loam about 9 inches thick. It is underlain by light brownish-gray loam and silt loam.

Farnuf soils, on fans, terraces, and foot slopes, are nearly level to sloping. The surface layer typically is very dark grayish-brown loam about 5 inches thick. The subsoil is grayish-brown and pale-brown loam and clay loam about 29 inches thick. It is underlain by light yellowish-brown loam.

Savage soils, on fans, terraces, and foot slopes, are nearly level to strongly sloping. The surface layer typically is dark grayish-brown silt loam about 2 inches thick. The subsoil is grayish-brown silty clay loam and silty clay about 21 inches thick. It is underlain by olive silty clay.

The main concerns of management are localized protection from spring flooding, proper irrigation, and control of erosion.

The soils in this association are used mostly for irrigated crops, but brushy areas on flood plains are used for pasture. Corn, sugar beets, small grain, and hay are the main crops grown. The main farm enterprises are growing crops for cash and growing hay and pasture for beef cattle.

## Soils Dominantly on High Gravel Terraces, Fans, and Benches

These soils are on high gravel terraces, fans, and benches. They formed in alluvium and in material weathered from sandstone and shale. Average annual precipitation is 10 to 18 inches, and the frost-free period is 90 to 125 days. The soils are used mostly for range and dryfarmed crops, but some areas are used for irrigated crops. The native vegetation is mainly mid and short grasses.

Five soil associations in the Big Horn County Area are on high gravel terraces, fans, and benches.

### 3. *Judith-Danvers-Windham association*

*Deep, nearly level to very steep and gently undulating to hilly, well-drained soils on fans, terraces, and benches*

This association consists of mostly level to very steep and gently undulating to hilly soils on terraces, fans, and benches.

This association makes up about 1 percent of the Area. It is about 30 percent Judith soils, 25 percent Danvers soils, 20 percent Windham soils, and 25 percent other soils. These other soils are in the Shaak, Lennep, Norbert, Eltsac, Amherst, and Maginnis series.

Judith soils are nearly level to steep and gently undulating to hilly. The surface layer typically is dark grayish-brown loam about 2 inches thick. The subsoil is grayish-brown clay loam about 28 inches thick. It is underlain by pale-brown, light-gray, and white loam and gravelly loam.

Danvers soils are nearly level and gently undulating to hilly. The surface layer is dark grayish-brown loam about 3 inches thick. The subsoil is grayish-brown and light yellowish-brown silty clay and silty clay loam about 12 inches thick. It is underlain by pale-yellow, brown, and light yellowish-brown silty clay loam and loam.

Windham soils are undulating to very steep. The surface layer typically is dark grayish-brown gravelly loam about 5 inches thick. It is underlain by dark grayish-brown and light brownish-gray gravelly loam that grades to very pale brown very gravelly loam at a depth of about 14 inches.

The main concerns of management are localized protection from spring flooding and control of erosion.

The soils in this association are used mostly for small grain, but the hilly to very steep soils are used for range.

### 4. *Keiser-Hydro-Gilt Edge association*

*Deep, nearly level to gently sloping and gently undulating, well-drained soils on terraces, fans, and benches*

This association consists of nearly level to gently sloping and gently undulating soils on terraces, fans, and benches.

This association makes up about 3 percent of the Area. It is about 30 percent Keiser soils, 20 percent Hydro soils, 15 percent Gilt Edge soils, and 35 percent other soils. These other soils are in the Shonkin, Colby, Harvey, and Clapper series.

Keiser soils are nearly level to gently sloping and



gently undulating. The surface layer typically is light brownish-gray loam about 1 inch thick. The subsoil is brown loam and silty clay loam about 20 inches thick. It is underlain by light brownish-gray silt loam.

Hydro soils are nearly level and gently sloping. The surface layer typically is light brownish-gray very fine sandy loam about 2 inches thick, and the subsurface layer is brown loam about 3 inches thick. The subsoil is grayish-brown silty clay and silty clay loam about 22 inches thick. It is underlain by light brownish-gray and olive-gray silty clay loam, silty clay, and silt loam.

Gilt Edge soils are nearly level and gently undulating. The surface layer typically is light brownish-gray and grayish-brown loam and silt loam about 3 inches thick. The subsoil is grayish-brown clay and silty clay about 3 inches thick. It is underlain by pale-yellow silty clay and silty clay loam.

The main concerns of management are localized protection from spring flooding and control of erosion.

The soils in this association are used mostly for dry-farmed small grain. They are suitable for irrigation.

##### **5. *Spearfish-Pultney-Stormitt association***

*Shallow to deep, nearly level to very steep, well-drained soils on fans, benches, and sedimentary uplands*

This association consists of nearly level to very steep soils on fans, benches, and sedimentary uplands.

This association makes up about 2 percent of the Area. It is about 25 percent Spearfish soils, 15 percent Pultney soils, 15 percent Stormitt soils, and 45 percent other soils and shale and limestone outcrops. These other soils are in the Terry, Travessilla, Harvey, and Chugter series.

Spearfish soils, on sedimentary uplands, are rolling to very steep. The surface layer typically is reddish-brown loam about 3 inches thick. It is underlain by red silty clay loam. Platy shale is at a depth of about 15 inches.

Pultney soils, on sedimentary uplands, are undulating to very steep. The surface layer typically is brown loam about 2 inches thick. The subsoil is brown loam about 4 inches thick. It is underlain by light-brown loam that grades to pink loam. Shale and sandstone are at a depth of about 30 inches.

Stormitt soils, on fans and benches, are nearly level to steep and hilly. The surface layer typically is brown loam about 4 inches thick. The subsoil is light-brown loam about 3 inches thick. It is underlain by light-brown loam that grades to pink loam and to very gravelly loam.

The main concerns of management are maintenance or improvement of rangeland vegetation and control of erosion.

The soils in this association are suited to range.

##### **6. *Wayden-Xavier-Belfield association***

*Shallow to deep, nearly level to very steep and gently undulating to hilly, well-drained soils on fans, terraces, foot slopes, benches, and sedimentary uplands*

This association consists of mostly nearly level to very steep and gently undulating to hilly soils on fans, terraces, foot slopes, benches, and sedimentary uplands.

This association makes up about 6 percent of the Area. It is about 30 percent Wayden soils, 20 percent Xavier soils, 10 percent Belfield soils, and 40 percent other soils. These other soils are in the Eltsac, Norbert, Shaak, Reeder, and Lennep series.

Wayden soils, on sedimentary uplands, are strongly sloping and very steep and rolling to hilly. The surface layer typically is grayish-brown silty clay loam about 2 inches thick. The subsoil is grayish-brown silty clay loam about 5 inches thick. The underlying material is light brownish-gray silty clay loam. Clay shale is at a depth of about 19 inches.

Xavier soils, on fans, terraces, and benches, are gently undulating to rolling. The surface layer typically is grayish-brown silt loam about 4 inches thick. The subsoil is dark-brown and pale-brown silty clay loam about 11 inches thick. It is underlain by pale-yellow and light yellowish-brown silt loam.

Belfield soils, on fans, terraces, foot slopes, and sedimentary uplands, are nearly level and gently undulating. The surface layer typically is light brownish-gray silt loam about 2 inches thick, and the subsurface layer is light brownish-gray silt loam about 3 inches thick. The subsoil is brown, grayish-brown, and light yellowish-brown silty clay and silty clay loam about 22 inches thick. It is underlain by light yellowish-brown and pale-yellow silty clay and silty clay loam.

The main concerns of management are maintenance or improvement of rangeland vegetation and control of erosion.

The soils in this association are used mostly for range. The Xavier and Belfield soils in this association are well suited to small grain and hay.

##### **7. *Beauvais association***

*Deep, gently undulating to hilly, well-drained soils on terraces, fans, foot slopes, and loess-covered hills*

This association consists of nearly level to steep and gently undulating to hilly soils on terraces, fans, and foot slopes.

This association makes up about 3 percent of the Area. It is about 40 percent Beauvais soils, 30 percent Colby soils, and 30 percent other soils and gravelly terrace edges. These other soils are in the Sofia, Gilt Edge, Shonkin, and Richfield series.

Beauvais soils are gently undulating to rolling. The surface layer typically is grayish-brown silty clay loam about 5 inches thick. The subsoil is brown silty clay about 4 inches thick. It is underlain by light-gray and light brownish-gray silty clay loam.

Colby soils are nearly level to moderately steep and gently undulating to hilly. The surface layer typically is grayish-brown silt loam about 5 inches thick. It is underlain by light brownish-gray silty clay loam.

The main concerns of management are localized protection from spring flooding, control of erosion, and maintenance or improvement of rangeland vegetation.

The soils in this association are used mostly for dryfarmed grain and range. Irrigated crops are also suited to these soils.



## Soils on Sandstone Hills

These soils are on sandstone hills. They formed in alluvium and in material weathered from sandstone. Average annual precipitation ranges from 13 to 18 inches, and the frost-free period is 100 to 125 days. The soils are used mostly for range, but some areas are used for dryfarmed crops. The native vegetation is mainly mid and short grasses.

Two soil associations in the Big Horn County Area are on sandstone hills.

### 8. *Nelson-Alice association*

*Moderately deep and deep, gently sloping to strongly sloping and undulating to rolling, well-drained soils on foot slopes, fans, valley bottoms, and sedimentary uplands*

This association consists of gently sloping to strongly sloping and undulating to rolling soils on foot slopes, fans, valley bottoms, and sedimentary uplands.

This association makes up about 1 percent of the Area. It is about 55 percent Nelson soils, 25 percent Alice soils, and 20 percent other soils and Rock outcrop. These other soils are in the Travessilla, Thedaland, Tullock, and Terry series and are on sedimentary uplands.

Nelson soils, on sedimentary uplands, are undulating to rolling. The surface layer typically is light olive-brown and grayish-brown fine sandy loam about 5 inches thick. It is underlain by light olive-brown and light yellowish-brown sandy loam that grades to pale-yellow sandy loam. Sandstone is at a depth of about 29 inches.

Alice soils, on foot slopes, fans, and valley bottoms, are gently sloping to strongly sloping and rolling. The surface layer typically is grayish-brown fine sandy loam about 2 inches thick. The subsoil is grayish-brown and light olive-brown sandy loam about 10 inches thick. It is underlain by light olive-brown, light yellowish-brown, and pale-yellow sandy loam and loamy sand.

The main concerns of management are maintenance or improvement of rangeland vegetation and control of erosion.

The soils in this association are used mostly for range, but small areas are used for dryfarmed hay.

### 9. *Dast-Vebar-Parshall association*

*Moderately deep and deep, undulating to hilly and strongly sloping to very steep, well-drained soils on foot slopes, fans, valley bottoms, and sedimentary uplands*

This association consists of mostly rolling to very steep soils on foot slopes, fans, valley bottoms, and sedimentary uplands.

This association makes up about 1 percent of the Area. It is about 40 percent Dast soils, 15 percent Vebear soils, 10 percent Parshall soils, and 35 percent other soils. These other soils are in the Farnuf, Shaak, Wayden, and Doney series.

Dast soils, on sedimentary uplands, are rolling to very steep. The surface layer typically is grayish-brown sandy loam about 3 inches thick. It is underlain by

light olive-brown and light yellowish-brown sandy loam. Sandstone is at a depth of about 24 inches.

Vebear soils, on sedimentary uplands, are undulating to hilly and steep. The surface layer typically is grayish-brown sandy loam about 2 inches thick. The subsoil is brown sandy loam and sandy clay loam about 25 inches thick. It is underlain by pale-yellow sandy loam. Sandstone is at a depth of about 40 inches.

Parshall soils, on foot slopes, fans, and valley bottoms, are strongly sloping and rolling. The surface layer typically is grayish-brown fine sandy loam about 2 inches thick. The subsoil is grayish-brown and dark-brown sandy loam about 17 inches thick. It is underlain by grayish-brown and light brownish-gray sandy loam and sandy clay loam.

The main concerns of management are maintenance or improvement of rangeland vegetation and control of erosion.

The soils in this association are used mostly for range, but small areas are used for dryfarmed small grain and hay. The main farm enterprise is raising beef cattle.

## Soils on Dissected Shale Hills

These soils are on dissected shale hills. They formed in alluvium and in material weathered from shale, sandstone, and siltstone. Average annual precipitation is 11 to 17 inches, and the frost-free period is 90 to 125 days. The soils are used mostly for range, but in one association some of the soils are used for dryfarmed crops. The native vegetation is mainly mid and short grasses.

Eight soil associations in the Big Horn County are on dissected shale hills.

### 10. *Pierre-Lismas-Kyle association*

*Shallow to deep, nearly level to very steep and gently undulating to hilly, well-drained soils on fans, foot slopes, terraces, and sedimentary uplands*

This association consists of nearly level to very steep and gently undulating to hilly soils on fans, foot slopes, terraces, and sedimentary uplands.

This association makes up about 9 percent of the Area. It is about 35 percent Pierre soils, 30 percent Lismas soils, 15 percent Kyle soils, and 20 percent other soils and Shale outcrop. These other soils are in the Vananda, Allentine, Arvada, and Bone series.

Pierre soils, on sedimentary uplands, are gently undulating to hilly and steep. The surface layer typically is grayish-brown silty clay and clay about 3 inches thick. The subsoil is light brownish-gray clay about 3 inches thick. It is underlain by pale-olive clay. Clay shale is at a depth of about 29 inches.

Lismas soils, on sedimentary uplands, are undulating to hilly and steep. The surface layer typically is light olive-gray clay about 1 inch thick. It is underlain by light olive-gray clay. Clay shale is at a depth of about 18 inches.

Kyle soils, on terraces, fans, and foot slopes, are nearly level to strongly sloping. The surface layer typically is grayish-brown silty clay about 2 inches thick. The subsoil is olive-gray clay and silty clay about 8 inches thick. It is underlain by pale-olive clay.



The main concerns in management are localized protection from spring overflow, control of erosion, and maintenance or improvement of rangeland vegetation.

The soils in this association are used mostly for range, but the nearly level to sloping undulating Pierre and Kyle soils are also suited to dryfarmed small grain.

#### **11. Thedalund-Midway association**

*Moderately deep and shallow, undulating to hilly and gently sloping to very steep, well-drained soils on sedimentary uplands*

This association consists of undulating to hilly and gently sloping to very steep soils on sedimentary uplands.

This association makes up about 19 percent of the Area. It is about 30 percent Thedalund soils, 30 percent Midway soils, and 40 percent other soils, Shale outcrop and Rock outcrop (sandstone). These other soils are in the McRae, Fort Collins, Thurlow, Cushman, and Nelson series.

Thedalund soils are undulating to very steep. The surface layer typically is grayish-brown loam about 2 inches thick. It is underlain by olive-brown, light yellowish-brown, and light-gray loam. Shale is at a depth of about 28 inches.

Midway soils are undulating to hilly and gently sloping to steep. The surface layer typically is light olive-gray silty clay loam about 2 inches thick. It is underlain by olive-gray silty clay loam. Shale is at a depth of about 11 inches.

The main concerns of management are maintenance or improvement of rangeland vegetation and control of erosion.

The soils in this association are suited to range.

#### **12. Wibaux-Thedalund-Spearman association**

*Shallow and moderately deep, undulating to very steep, well-drained to excessively drained soils on sedimentary uplands*

This association consists of undulating to very steep soils on sedimentary uplands.

This association makes up about 5 percent of the Area. It is about 30 percent Wibaux soils, 20 percent Thedalund soils, 20 percent Spearman soils, and 30 percent other soils. These other soils are in the Nelson, Chugter, Cushman, Hydro, and McRae series.

Wibaux soils are undulating to very steep. The surface layer typically is reddish-brown channery loam about 2 inches thick. It is underlain by reddish-brown very channery loam. Shale and sandstone are at a depth of about 9 inches.

Thedalund soils are undulating to very steep. The surface layer typically is grayish-brown loam about 2 inches thick. It is underlain by olive-brown, light yellowish-brown, and light-gray loam. Shale is at a depth of about 28 inches.

Spearman soils are undulating to rolling. The surface layer typically is reddish-brown loam and clay loam about 4 inches thick. The subsoil is reddish-brown clay loam about 11 inches thick. It is underlain by light reddish-brown channery loam and loam. Shale is at a depth of about 23 inches.

The main concerns of management are maintenance

or improvement of rangeland vegetation and control of erosion.

The soils in this association are used mostly for range. Coal mining has increased in this association.

#### **13. Ringling-Searing-Arnegard association**

*Shallow to deep, gently sloping to very steep and undulating to hilly, well-drained soils on fans, foot slopes, and sedimentary uplands*

This association consists of gently sloping to very steep and undulating to hilly soils on sedimentary uplands, fans, and foot slopes.

This association makes up about 8 percent of the Area. It is about 30 percent Ringling soils, 20 percent Searing soils, 15 percent Arnegard soils, and 35 percent other soils and Rock outcrop. These other soils are in the Farnuf, Savage, Reeder, Doney, and Grail series.

Ringling soils, on sedimentary uplands, are rolling to very steep. The surface layer typically is reddish-brown channery loam. It is underlain by reddish-brown very channery loam. Shale is at a depth of about 13 inches.

Searing soils, on sedimentary uplands, are undulating to hilly and steep. The surface layer typically is dark reddish-gray loam about 6 inches thick. The subsoil is reddish-brown loam and clay loam about 18 inches thick. It is underlain by red loam. Shale and sandstone are at a depth of about 30 inches.

Arnegard soils, on fans and foot slopes, are gently sloping to steep and hilly. The surface layer typically is very dark grayish-brown and very dark gray loam about 14 inches thick. The subsoil is dark grayish-brown clay loam about 17 inches thick. It is underlain by dark-brown clay loam and loam.

The main concerns of management are localized protection from flooding of dryfarmed crops, maintenance or improvement of rangeland vegetation, and control of erosion.

The soils in this association are used mostly for range, but some of the Arnegard soils are used for dryfarmed crops.

#### **14. Doney-Reeder-Wayden association**

*Moderately deep and shallow, gently undulating to very steep, well-drained soils on sedimentary uplands*

This association consists of gently undulating to very steep soils on sedimentary uplands.

This association makes up about 9 percent of the Area. It is about 30 percent Doney soils, 20 percent Reeder soils, 20 percent Wayden soils, and 30 percent other soils. These other soils are in the Farnuf, Shaak, Savage, and Dast series.

Doney soils are sloping and rolling to very steep. The surface layer typically is grayish-brown loam about 6 inches thick. It is underlain by light yellowish-brown and pale-yellow loam. Shale and sandstone are at a depth of about 24 inches.

Reeder soils are gently undulating to hilly. The surface layer typically is dark grayish-brown loam about 4 inches thick. It is underlain by pale-brown clay loam and loam. Shale and sandstone are at a depth of about 30 inches.



Wayden soils are strongly sloping to very steep and rolling to hilly. The surface layer typically is grayish-brown silty clay loam about 5 inches thick. The substratum is light brownish-gray silty clay loam. Shale is at a depth of about 19 inches.

The main concerns of management are maintenance or improvement of rangeland vegetation and control of erosion.

The soils in this association are used for range.

#### 15. Midway-Nunn association

*Shallow to deep, nearly level to steep and undulating to hilly, well-drained soils on terraces, fans, foot slopes, and sedimentary uplands*

This association consists of nearly level to steep and undulating to hilly soils on terraces, fans, foot slopes, and sedimentary uplands.

This association makes up about 2 percent of the Area. It is about 45 percent Midway soils, 30 percent Nunn soils, and 25 percent other soils. These other soils are in the Thedalund, Heldt, and Pierre series.

Midway soils, on sedimentary uplands, are gently sloping to steep and undulating to hilly. The surface layer typically is light olive-gray silty clay loam about 2 inches thick. It is underlain by olive-gray silty clay loam. Shale is at a depth of about 11 inches.

Nunn soils, on fans, terraces, and foot slopes, are nearly level to moderately steep. The surface layer typically is grayish-brown silty clay loam about 8 inches thick. The subsoil is grayish-brown and light olive-brown silty clay and clay loam about 15 inches thick. It is underlain by stratified clay loam, silt loam, and sandy clay loam.

The main concerns of management are maintenance or improvement of rangeland vegetation and control of erosion.

The soils in this association are used mostly for range.

#### 16. Wayden-Regent-Shale outcrop association

*Shallow and moderately deep, gently undulating to hilly and strongly sloping to very steep, well-drained soils and Shale outcrop on sedimentary uplands*

This association consists of gently undulating to hilly and strongly sloping to very steep soils and Shale outcrop on sedimentary uplands.

This association makes up about 4 percent of the Area. It is about 40 percent Wayden soils, 25 percent Regent soils, 15 percent Shale outcrop, and 20 percent other soils and Rock outcrop. These other soils are in the Lennep, Savage, Cherry, and Doney series.

Wayden soils are strongly sloping to very steep and rolling to hilly. The surface layer typically is grayish-brown silty clay loam about 2 inches thick. The subsoil is grayish-brown silty clay loam about 5 inches thick. It is underlain by light brownish-gray silty clay loam. Shale is at a depth of about 19 inches.

Regent soils are gently undulating to hilly and steep. The surface layer typically is grayish-brown silty clay loam about 3 inches thick. The subsoil is grayish-brown and pale-olive silty clay loam about 13 inches thick. It is underlain by light-gray silty clay loam. Shale is at a depth of about 26 inches.

The main concerns of management are maintenance or improvement of rangeland vegetation and control of erosion.

The soils in this association are mostly suited to range.

#### 17. Midway association

*Shallow and moderately deep, undulating to hilly and gently sloping to very steep, well-drained soils on sedimentary uplands*

This association consists of undulating to hilly and gently sloping to very steep soils on sedimentary uplands.

This association makes up about 2 percent of the Area. It is about 35 percent Midway soils, 25 percent Thedalund soils, and 40 percent other soils. These other soils are in the Cushman, Terry, Nelson, Thurlow, McRae, Keiser, and Fort Collins series.

Midway soils are gently sloping to steep and undulating to hilly. The surface layer typically is light olive-gray silty clay loam about 2 inches thick. It is underlain by olive-gray silty clay loam. Shale is at a depth of about 11 inches.

Thedalund soils are undulating to very steep. The surface layer typically is grayish-brown loam about 2 inches thick. It is underlain by olive-brown, light yellowish-brown, and light-gray loam. Shale is at a depth of about 28 inches.

The main concerns of management are maintenance or improvement of rangeland vegetation and control of erosion.

The soils in this association are used mostly for range.

#### Soils on Intermixed Dissected Shale and Sandstone Hills

These soils are on intermixed dissected shale and sandstone hills. They formed in material weathered from sandstone and shale. Average annual precipitation is 12 to 18 inches, and the frost-free period is 90 to 125 days. The soils are used mostly for range, but in one association some of the soils are used for dry-farmed crops. The native vegetation is mainly mid and short grasses.

Five soil associations in the Big Horn County Area are on intermixed dissected shale and sandstone hills.

#### 18. Abac-Peritsa association

*Shallow and moderately deep, undulating to rolling and very steep, well-drained soils on sedimentary uplands*

This association consists of undulating to rolling and very steep soils on sedimentary uplands.

This association makes up about 3 percent of the Area. It is about 35 percent Abac soils, 25 percent Peritsa soils, and 40 percent other soils. These other soils are in the Rottulee, Wayden, Twin Creek, and Fergus series.

Abac soils are rolling to very steep. The surface layer typically is reddish-brown silt loam about 3 inches thick. It is underlain by dark-red loam that is about 30 percent shale fragments. Shale is at a depth of about 19 inches.



Peritsa soils are undulating and rolling. The surface layer typically is reddish-brown silt loam about 3 inches thick. The subsoil is reddish-brown and red silty clay loam about 11 inches thick. It is underlain by light-red silty clay loam.

The main concerns of management are maintenance or improvement of rangeland vegetation and control of erosion.

The soils in this association are used mostly for range.

#### 19. *Absarokee-Maginnis association*

*Moderately deep and shallow, gently undulating to hilly and gently sloping to very steep, well-drained soils on sedimentary uplands*

This association consists of gently undulating to hilly and gently sloping to very steep soils on sedimentary uplands.

This association makes up about 1 percent of the Area. It is about 40 percent Absarokee soils, 25 percent Maginnis soils, and 35 percent other soils and Shale outcrop. These other soils are in the Norbert, Eltsac, Castner, and Reeder series.

Absarokee soils are gently sloping to steep and gently undulating to hilly. The surface layer typically is grayish-brown silty clay loam about 6 inches thick. The subsoil is brown silty clay loam and clay about 18 inches thick. It is underlain by pale-yellow clay. Shale and sandstone are at a depth of 31 inches.

Maginnis soils are hilly and very steep. The surface layer typically is grayish-brown channery loam and silty clay loam about 6 inches thick. The subsoil is grayish-brown channery silty clay loam about 4 inches thick. It is underlain by very channery clay. Shale and sandstone are at a depth of about 16 inches.

The main concerns of management are localized protection from spring flooding of dryfarmed crops, maintenance or improvement of rangeland vegetation, and control of erosion.

The Absarokee soil in this association is suited to dryfarmed small grain where slopes are gently undulating to hilly. The Maginnis soil is suited to range.

#### 20. *Absarokee association*

*Moderately deep, gently undulating to hilly and gently sloping to steep, well-drained soils on sedimentary uplands*

This association consists of gently undulating to hilly and gently sloping to steep soils on sedimentary uplands.

This association makes up about 1 percent of the Area. It is about 55 percent Absarokee soils, 20 percent Castner soils, and 25 percent other soils and Rock outcrop. These other soils are in the Reeder, Arming-ton, Lennep, and Wayden series.

Absarokee soils are gently sloping to steep and gently undulating to hilly. The surface layer typically is grayish-brown silty clay loam about 6 inches thick. The subsoil is brown silty clay loam and clay about 18 inches thick. It is underlain by pale-yellow clay. Shale and sandstone are at a depth of 31 inches.

Castner soils are undulating to hilly and steep. The surface layer typically is dark grayish-brown sandy

loam about 3 inches thick. The subsoil is dark-brown sandy loam about 7 inches thick. It is underlain by brown sandy loam. Sandstone and shale are at a depth of about 12 inches.

The main concerns of management are localized protection from spring flooding of dryfarmed crops, maintenance or improvement of rangeland vegetation, and control of erosion.

The Absarokee soil in this association is suited to dryfarmed small grain. The Castner soil is suited to range.

#### 21. *Wayden-Castner association*

*Shallow, undulating to hilly and strongly sloping to very steep, well-drained soils on sedimentary uplands*

This association consists of undulating to hilly and strongly sloping to very steep soils on sedimentary uplands.

This association makes up about 3 percent of the Area. It is about 35 percent Wayden soils, 20 percent Castner soils, and 45 percent other soils and Rock outcrop. These other soils are in the Regent, Lap, and Rottulee series.

Wayden soils are strongly sloping to very steep and rolling to hilly. The surface layer typically is grayish-brown silty clay loam about 2 inches thick. The subsoil is grayish-brown silty clay loam about 5 inches thick. It is underlain by light brownish-gray silty clay loam. Shale is at a depth of about 19 inches.

Castner soils are undulating to hilly and steep. The surface layer typically is dark grayish-brown sandy loam about 3 inches thick. The subsoil is dark-brown sandy loam. Shale and sandstone are at a depth of about 12 inches.

The main concerns of management are maintenance or improvement of rangeland vegetation and control of erosion.

The soils in this association are suited to range.

#### 22. *Thedalund-Travessilla association*

*Moderately deep and shallow, undulating to rolling and very steep, well-drained soils on sedimentary uplands*

This association consists of undulating to rolling and very steep soils on sedimentary uplands.

This association makes up about 2 percent of the Area. It is about 35 percent Thedalund soils, 20 percent Travessilla soils, 15 percent Rock outcrop, and 30 percent other soils. These other soils are in the Nelson, Cushman, Midway, McRae, Fort Collins, Colby, and Clapper series.

Thedalund soils are undulating to very steep. The surface layer typically is grayish-brown loam about 2 inches thick. It is underlain by olive-brown, light yellowish-brown, and light-gray loam. Shale is at a depth of about 28 inches.

Travessilla soils are undulating and rolling. The surface layer typically is grayish-brown sandy loam about 2 inches thick. It is underlain by channery sandy loam. Sandstone is at a depth of about 18 inches.

The main concerns of management are maintenance or improvement of rangeland vegetation and control of erosion.

The soils in this association are suited to range.



## Soils on Mountains

These soils are on mountains. They formed in material weathered from shale, siltstone, limestone, and sandstone. Average annual precipitation ranges from 14 to 24 inches, and the frost-free period is 60 to 110 days. The soils are used mainly for range. The native vegetation is mainly mid and short grasses.

Two soil associations in the Big Horn County Area are on mountains.

### 23. *Duncom-Tarrete-Mayflower association*

*Shallow and moderately deep, rolling to hilly and strongly sloping to very steep, well-drained soils on sedimentary highlands*

This association consists of rolling to hilly and strongly sloping to very steep soils on sedimentary highlands.

This association makes up about 5 percent of the Area. It is about 25 percent Duncom soils, 20 percent Tarrete soils, 20 percent Mayflower soils, and 35 percent other soils. These other soils are in the Sawcreek, Ryorp, Adel, and Babb series.

Duncom soils are rolling to very steep. The surface layer typically is very dark grayish-brown gravelly loam about 4 inches thick. It is underlain by grayish-brown and pale-brown gravelly and very gravelly loam. Limestone is at a depth of about 18 inches.

Tarrete soils are strongly sloping to steep and rolling and hilly. The surface layer typically is dark reddish-brown loam about 4 inches thick. The subsoil is red silty clay and clay about 19 inches thick. It is underlain by light-red clay. Shale is at a depth of about 35 inches.

Mayflower soils are rolling and strongly sloping. The surface layer typically is dark grayish-brown silt loam about 11 inches thick. The subsoil is brown and reddish-brown silty clay and clay about 18 inches thick. It is underlain by light reddish-brown silty clay loam. Shale is at a depth of about 34 inches.

The main concerns of management are maintenance or improvement of rangeland vegetation and control of erosion.

The soils in this association are used for range.

### 24. *Lap-Armington-Reeder association*

*Shallow to deep, undulating to hilly and strongly sloping to very steep, well-drained soils on sedimentary highlands*

This association consists of undulating to hilly and strongly sloping to very steep soils on sedimentary highlands.

This association makes up about 4 percent of the Area. It is about 35 percent Lap soils, 20 percent Armington soils, 20 percent Reeder soils, and 25 percent other soils and Rock outcrop. These other soils are in the Castner, Vebar, Windham, and Darret series.

Lap soils are undulating to strongly sloping. The surface layer typically is dark grayish-brown channery loam about 4 inches thick. It is underlain by light brownish-gray and light-gray very channery and very stony loam. Limestone is at a depth of about 19 inches.

Armington soils are gently sloping to strongly slop-

ing and rolling. The surface layer typically is reddish-brown silty clay about 4 inches thick. The subsoil is reddish-brown and weak-red clay about 29 inches thick.

Reeder soils are undulating to hilly. The surface layer is dark grayish-brown loam about 4 inches thick. The subsoil is brown loam and clay loam about 17 inches thick. It is underlain by pale-brown clay loam and loam. Sandstone and shale are at a depth of about 30 inches.

The main concerns of management are maintenance or improvement of rangeland vegetation and control of erosion.

The soils in this association are used for range.

## Descriptions of the Soils

This section describes the soil series and mapping units in the Big Horn County Area. Each soil series is described in detail, and then, briefly, each mapping unit in that series is described. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. The profile described in the series is representative of mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit. Color terms are for dry soil unless otherwise stated.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Riverwash and Terrace escarpments, gravelly, for example, do not belong to a soil series; nevertheless, they are listed in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit are the capability unit, range site, and windbreak suitability group in which the mapping unit has been placed. The page for the description of each interpretative group can be learned by referring to the "Guide to Mapping Units" at the back of his survey.

The soils in the Big Horn County Area were mapped at either low intensity or medium intensity. Low-intensity mapping units were examined at moderate to wide intervals. A wide range of slope was permitted if it did not significantly affect use and management. Medium-intensity units were examined at closer intervals and were mapped in more detail and at a larger scale. Low-intensity units can be identified be-

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent	Soil	Acres	Percent
Abac loam, rolling	1,648	0.1	Colby silty clay loam, 1 to 4 percent slopes	889	( <sup>1</sup> )
Abac loam, hilly	33,756	1.1	Colby silty clay loam, 4 to 8 percent slopes	6,984	.2
Abac-Bitton complex, hilly	1,818	.1	Colby silty clay loam, 8 to 15 percent slopes	3,217	.1
Abac-Rock outcrop complex, very steep	21,020	.7	Colby-Beauvais silt loams, undulating	2,847	.1
Absarokee silty clay loam, gently undulating	2,310	.1	Colby-Beauvais silt loams, rolling	1,202	( <sup>1</sup> )
Absarokee silty clay loam, undulating	5,026	.2	Colby-Clapper silt loams, rolling	7,178	.2
Absarokee silty clay loam, rolling	2,120	.1	Colby-Keiser silty clay loams, 4 to 8 percent slopes	6,264	.2
Absarokee silty clay loam, hilly	1,790	.1	Colby-Midway complex, 8 to 15 percent slopes	10,910	.4
Absarokee-Castner complex, undulating	3,811	.1	Colby association, rolling	3,984	.1
Absarokee-Castner complex, hilly	608	( <sup>1</sup> )	Colby association, hilly	6,732	.2
Absarokee-Armington association, gently sloping	2,388	.1	Cushman loam, undulating	2,746	.1
Absher-Nobe clays	6,446	.2	Danvers silty clay loam, 0 to 1 percent slopes	2,190	.1
Adel-Mayflower association, sloping	5,150	.2	Danvers silty clay loam, gently undulating	4,128	.1
Adger clay, 0 to 8 percent slopes	2,268	.1	Danvers silty clay loam, undulating	1,623	.1
Alice fine sandy loam, 4 to 15 percent slopes	2,219	.1	Danvers cobbly silty clay loam, 1 to 4 percent slopes	2,657	.1
Allentine clay, 0 to 2 percent slopes	1,620	.1	Danvers-Judith silty clay loams, gently undulating	3,042	.1
Allentine clay, 2 to 4 percent slopes	921	( <sup>1</sup> )	Danvers-Judith silty clay loams, undulating	5,348	.2
Allentine-Bone complex, 0 to 1 percent slopes	2,300	.1	Danvers-Judith silty clay loams, hilly	4,002	.1
Allentine-Bone complex, 1 to 4 percent slopes	7,222	.2	Dast sandy loam, rolling	2,062	.1
Alluvial land, gravelly	1,684	.1	Dast sandy loam, hilly	934	( <sup>1</sup> )
Alluvial land, cobbly	2,662	.1	Dast complex, hilly	6,809	.2
Alluvial land, wet	1,822	.1	Dast complex, very steep	4,705	.2
Amherst loam, undulating	2,249	.1	Dast-Parshall sandy loams, rolling	7,561	.3
Amherst loam, rolling	2,120	.1	Doney loam, rolling	2,671	.1
Amherst complex, rolling	510	( <sup>1</sup> )	Doney silty clay loam, hilly	2,040	.1
Amherst complex, hilly	6,870	.2	Doney-Reeder loams, rolling	23,935	.8
Amherst-Maginnis complex, hilly	7,076	.2	Doney-Ringling complex, rolling	2,809	.1
Armington silty clay loam	256	( <sup>1</sup> )	Doney-Ringling complex, hilly	19,686	.7
Armington complex, rolling	1,194	( <sup>1</sup> )	Doney-Ringling complex, very steep	23,132	.8
Arnegard loam, 8 to 15 percent slopes	2,890	.1	Doney-Rock outcrop complex, very steep	2,155	.1
Arnegard silt loam, 2 to 4 percent slopes	611	( <sup>1</sup> )	Doney-Wayden complex, hilly	56,953	1.9
Arnegard silt loam, 4 to 8 percent slopes	625	( <sup>1</sup> )	Duncom extremely channery loam, rolling	7,410	.2
Arvada silty clay loam	2,686	.1	Duncom complex, rolling	5,381	.2
Arvada-Bone clays	12,849	.4	Duncom-Tarrete association, rolling	50,437	1.7
Ascalon sandy loam, 4 to 8 percent slopes	1,187	( <sup>1</sup> )	Duncom-Tarrete association, hilly	147,305	4.8
Babb silt loam, rolling	5,423	.2	Eltsac clay, undulating	1,080	( <sup>1</sup> )
Babb silt loam, hilly	10,241	.3	Eltsac clay, rolling	26,612	.9
Beauvais silty clay loam, gently undulating	9,355	.3	Eltsac cobbly clay, hilly	3,206	.1
Beauvais silty clay loam, undulating	6,096	.2	Farnuf loam, 0 to 2 percent slopes	1,071	( <sup>1</sup> )
Beauvais silty clay loam, rolling	1,263	( <sup>1</sup> )	Farnuf loam, 2 to 4 percent slopes	816	( <sup>1</sup> )
Beauvais-Gilt Edge silty clay loams, gently undulating	775	( <sup>1</sup> )	Farnuf loam, 4 to 8 percent slopes	830	( <sup>1</sup> )
Belfield silt loam, 0 to 1 percent slopes	1,333	( <sup>1</sup> )	Farnuf-Doney association, sloping	23,318	.8
Belfield silt loam, gently undulating	6,024	.2	Fergus silt loam, 2 to 4 percent slopes	1,656	.1
Belfield silt loam, undulating	2,595	.1	Fergus silt loam, 4 to 8 percent slopes	2,382	.1
Belfield-Adger complex, 0 to 1 percent slopes	269	( <sup>1</sup> )	Fergus silt loam, 8 to 15 percent slopes	1,168	( <sup>1</sup> )
Belfield-Adger complex, gently undulating	931	( <sup>1</sup> )	Fort Collins loam, 0 to 2 percent slopes	1,716	.1
Belfield-Adger complex, undulating	2,175	.1	Fort Collins loam, 2 to 4 percent slopes	3,553	.1
Benteen loam, rolling	3,744	.1	Fort Collins loam, 4 to 8 percent slopes	10,442	.3
Benteen loam, hilly	6,192	.2	Fort Collins loam, channeled, 4 to 8 percent slopes	3,102	.1
Bew silty clay loam, 0 to 1 percent slopes	1,100	( <sup>1</sup> )	Frazer silty clay loam	2,375	.1
Bew silty clay loam, gently undulating	1,028	( <sup>1</sup> )	Frazer silty clay loam, saline	636	( <sup>1</sup> )
Bitton gravelly loam, 2 to 8 percent slopes	624	( <sup>1</sup> )	Frazer silty clay	264	( <sup>1</sup> )
Bitton soils, hilly	3,373	.1	Frazer and Korchea soils, channeled	3,820	.1
Bone clay	596	( <sup>1</sup> )	Gilt Edge silty clay loam, 0 to 2 percent slopes	3,798	.1
Castner-Reeder loams, undulating	6,756	.2	Gilt Edge silty clay loam, 2 to 4 percent slopes	3,412	.1
Castner-Reeder loams, rolling	10,083	.3	Gilt Edge-Bone complex, 0 to 1 percent slopes	1,435	.1
Castner-Rock outcrop complex, rolling	4,523	.2	Gilt Edge-Bone complex, 1 to 4 percent slopes	2,684	.1
Castner-Vebar sandy loams, hilly	2,544	.1	Glenberg fine sandy loam, 0 to 2 percent slopes	992	( <sup>1</sup> )
Cherry silty clay loam, 2 to 8 percent slopes	2,602	.1	Glenberg fine sandy loam, 2 to 4 percent slopes	286	( <sup>1</sup> )
Chugter loam, 2 to 8 percent slopes	3,085	.1			
Chugter complex, 2 to 15 percent slopes	1,977	.1			
Clapper-Harvey complex, rolling	8,540	.3			
Clapper-Midway complex, hilly	21,208	.7			
Colby silt loam, 4 to 8 percent slopes	8,127	.3			
Colby silt loam, 8 to 15 percent slopes	2,751	.1			



TABLE 1.—Approximate acreage and proportionate extent of the soils—Continued

Soil	Acres	Percent	Soil	Acres	Percent
Glenberg fine sandy loam, 4 to 8 percent slopes	176	( <sup>1</sup> )	Keiser silty clay loam, 2 to 4 percent slopes	10,845	.4
Glenberg loam, 0 to 2 percent slopes	918	( <sup>1</sup> )	Keiser silty clay loam, 4 to 8 percent slopes	3,082	.1
Grail clay loam, 0 to 2 percent slopes	748	( <sup>1</sup> )	Keiser-Colby complex, gently undulating	3,568	.1
Grail clay loam, 2 to 8 percent slopes	2,196	.1	Kim loam, 4 to 15 percent slopes	6,532	.2
Grail clay loam, 8 to 15 percent slopes	572	( <sup>1</sup> )	Korchea loam, 0 to 2 percent slopes	1,369	( <sup>1</sup> )
Grail clay loam, 15 to 35 percent slopes	4,393	.1	Korchea loam, 2 to 4 percent slopes	694	( <sup>1</sup> )
Grail silty clay, 0 to 2 percent slopes	918	( <sup>1</sup> )	Korchea silt loam, 0 to 2 percent slopes	697	( <sup>1</sup> )
Hanson extremely stony loam, rolling	1,649	.1	Korchea silt loam, frequently flooded	2,974	.1
Hanson-Babb association, very steep	48,326	1.6	Korchea silty clay loam, 0 to 2 percent slopes	1,610	.1
Harvey loam, gently undulating	636	( <sup>1</sup> )	Korchea silty clay loam, 2 to 4 percent slopes	239	( <sup>1</sup> )
Harvey loam, undulating	3,213	.1	Korchea and Frazer soils, water table	16,467	.5
Harvey loam, rolling	2,940	.1	Kyle silty clay, 0 to 2 percent slopes	6,030	.2
Harvey gravelly loam, undulating	1,351	( <sup>1</sup> )	Kyle silty clay, 2 to 4 percent slopes	3,115	.1
Harvey complex, undulating	3,682	.1	Kyle silty clay, 4 to 8 percent slopes	4,342	.1
Haverson loam, 0 to 2 percent slopes	5,442	.2	Kyle gravelly silty clay, 8 to 15 percent slopes	5,212	.2
Haverson loam, 2 to 4 percent slopes	1,174	( <sup>1</sup> )	Kyle clay, saline	2,345	.1
Haverson loam, saline	1,005	( <sup>1</sup> )	La Fonda loam, 2 to 4 percent slopes	782	( <sup>1</sup> )
Haverson silty clay loam	2,611	.1	Lap-Trulon complex, rolling	2,782	.1
Haverson silty clay	494	( <sup>1</sup> )	Lap association, undulating	3,757	.1
Haverson silty clay, thick surface	1,290	( <sup>1</sup> )	Lap association, rolling	4,459	.2
Haverson-Hyham silty clay loams	7,933	.3	Lap-Armington association, rolling	75,613	2.4
Haverson and Glenberg soils	4,115	.1	Lavina-Travessilla loams, undulating	3,613	.1
Haverson and Lohmiller soils, channeled	20,962	.7	Lennepe loam, 2 to 4 percent slopes	6,817	.2
Haverson and Lohmiller soils, frequently flooded	1,591	.1	Lennepe loam, 4 to 8 percent slopes	4,474	.2
Haverson and Lohmiller soils, wet	1,248	( <sup>1</sup> )	Lennepe-Adger complex, gently undulating	2,480	.1
Haverson soils, saline	1,100	( <sup>1</sup> )	Lennepe-Adger complex, undulating	1,897	.1
Heldt silty clay loam, 0 to 2 percent slopes	1,027	( <sup>1</sup> )	Lismas clay, undulating	875	( <sup>1</sup> )
Heldt silty clay loam, 2 to 4 percent slopes	3,409	.1	Lismas gravelly clay, rolling	13,010	.4
Heldt silty clay loam, 4 to 8 percent slopes	13,140	.4	Lismas gravelly clay, hilly	36,538	1.2
Heldt silty clay loam, 8 to 15 percent slopes	481	( <sup>1</sup> )	Lismas-Shale outcrop complex, rolling	38,056	1.3
Heldt silty clay, 0 to 2 percent slopes	805	( <sup>1</sup> )	Lismas-Shale outcrop complex, steep	49,378	1.6
Heldt-Hyham silty clay loams, 0 to 2 percent slopes	2,750	.1	Lismas-Vananda clays, undulating	17,899	.6
Heldt-Hyham silty clay loams, 2 to 4 percent slopes	3,589	.1	Lohmiller silty clay loam, 0 to 2 percent slopes	2,243	.1
Hesper silty clay loam, 0 to 1 percent slopes	973	( <sup>1</sup> )	Lohmiller silty clay loam, 2 to 4 percent slopes	619	( <sup>1</sup> )
Hesper silty clay loam, 1 to 4 percent slopes	2,601	.1	Lohmiller silty clay loam, 4 to 8 percent slopes	1,668	.1
Hesper silty clay loam, 4 to 8 percent slopes	6,647	.2	Lohmiller silty clay loam, 8 to 15 percent slopes	1,549	.1
Hydro loam, 0 to 8 percent slopes	11,141	.4	Lohmiller silty clay, saline, 0 to 2 percent slopes	1,184	( <sup>1</sup> )
Hydro silt loam, 0 to 2 percent slopes	1,338	( <sup>1</sup> )	Lohmiller silty clay, saline, 2 to 4 percent slopes	103	( <sup>1</sup> )
Hydro silt loam, 2 to 4 percent slopes	2,396	.1	Lohmiller-Midway silty clay loams, undulating	1,946	.1
Hydro silt loam, 4 to 8 percent slopes	689	( <sup>1</sup> )	Macar loam, 4 to 8 percent slopes	1,172	( <sup>1</sup> )
Hydro silty clay loam, 0 to 2 percent slopes	5,072	.2	Maginnis-Shale outcrop complex, very steep	1,910	.1
Hydro silty clay loam, 2 to 4 percent slopes	1,661	.1	Maginnis-Windham complex, hilly	2,110	.1
Hydro-Allentine complex, 1 to 4 percent slopes	7,571	.3	Marias clay, 0 to 2 percent slopes	582	( <sup>1</sup> )
Hydro-Allentine complex, 4 to 8 percent slopes	10,910	.4	Marias clay, 2 to 4 percent slopes	531	( <sup>1</sup> )
Hydro-Gilt Edge complex, 0 to 1 percent slopes	5,088	.2	Marias clay, 4 to 8 percent slopes	1,653	.1
Hysham loam, 0 to 2 percent slopes	1,758	.1	Marias clay, 8 to 15 percent slopes	1,040	( <sup>1</sup> )
Hysham silty clay loam, 4 to 8 percent slopes	1,559	.1	Maschetah complex, rolling	2,219	.1
Hysham silty clay loam, channeled, 0 to 4 percent slopes	1,387	.1	Maschetah-Norbert complex, hilly	19,716	.6
Hysham-Midway silty clay loams, 4 to 15 percent slopes	2,206	.1	Mayflower silt loam, rolling	1,952	.1
Hysham and Lohmiller silty clay loams, 0 to 8 percent slopes	1,759	.1	Mayflower association, rolling	7,127	.2
Judith clay loam, 0 to 2 percent slopes	242	( <sup>1</sup> )	McKenzie clay	538	( <sup>1</sup> )
Judith clay loam, 2 to 4 percent slopes	759	( <sup>1</sup> )	McRae loam, 0 to 1 percent slopes	1,649	.1
Judith clay loam, 4 to 8 percent slopes	599	( <sup>1</sup> )	McRae loam, 1 to 4 percent slopes	5,488	.2
Judith-Windham complex, 4 to 8 percent slopes	2,969	.1	McRae loam, 4 to 8 percent slopes	23,264	.8
Judith-Windham complex, 8 to 15 percent slopes	26,105	.9	McRae silty clay loam, 0 to 1 percent slopes	685	( <sup>1</sup> )
Keiser silty clay loam, 0 to 2 percent slopes	1,394	.1	Midway silty clay loam, undulating	10,897	.4
			Midway silty clay loam, rolling	33,557	1.1
			Midway silty clay loam, hilly	47,008	1.5
			Midway-Lismas complex, rolling	13,091	.4
			Midway-Lismas complex, hilly	14,077	.5
			Midway-Thedalund complex, rolling	37,270	1.2



TABLE 1.—Approximate acreage and proportionate extent of the soils—Continued

Soil	Acres	Percent	Soil	Acres	Percent
Midway-Thedalund complex, hilly	139,138	4.5	Searing loam, undulating	1,566	.1
Midway-Thurlow association, rolling	276	( <sup>1</sup> )	Searing loam, hilly	7,456	.3
Morton silt loam, undulating	2,635	.1	Searing-Ringling complex, rolling	1,980	.1
Nelson fine sandy loam, undulating	19,889	.7	Shaak clay loam, 4 to 8 percent slopes	3,648	.1
Nelson-Alice fine sandy loams, rolling	6,937	.2	Shaak silty clay loam, 0 to 2 percent slopes	2,626	.1
Nelson-Glenberg sandy loams, undulating	14,716	.5	Shaak silty clay loam, gently undulating	3,325	.1
Neville loam, rolling	2,635	.1	Shaak silty clay loam, undulating	4,376	.1
Norbert-Eltsac clays, hilly	44,225	1.5	Shaak silty clay loam, rolling	4,799	.2
Norbert-Shale outcrop complex, steep	34,526	1.1	Shaak complex, 4 to 15 percent slopes	13,523	.4
Nunn silty clay loam, 0 to 1 percent slopes	744	( <sup>1</sup> )	Shale outcrop	5,272	.2
Nunn silty clay loam, 1 to 4 percent slopes	4,015	.1	Shale outcrop-Midway complex, steep	14,144	.5
Nunn silty clay loam, 4 to 8 percent slopes	6,266	.2	Shale outcrop-Norbert complex, hilly	4,052	.1
Nunn silty clay loam, 8 to 15 percent slopes	6,847	.2	Shonkin clay loam	2,013	.1
Nunn-Midway silty clay loams, 4 to 15 percent slopes	7,312	.2	Sofia silty clay, 0 to 2 percent slopes	2,515	.1
Olney fine sandy loam, 4 to 12 percent slopes	1,760	.1	Sofia silty clay, gently undulating	6,391	.2
Parshall fine sandy loam, 4 to 8 percent slopes	1,195	( <sup>1</sup> )	Spearfish-Clapper complex, hilly	6,856	.2
Peritsa silt loam, undulating	7,757	.3	Spearfish-Rock outcrop complex, very steep	9,714	.3
Peritsa-Abac loams, rolling	12,844	.4	Spearfish-Pultney association, rolling	6,150	.2
Peritsa complex, rolling	2,480	.1	Spearfish-Pultney association, hilly	17,858	.6
Pierre clay, undulating	13,446	.4	Spearman loam, undulating	2,724	.1
Pierre clay, rolling	13,670	.5	Spearman-Wibaux complex, rolling	11,578	.4
Pierre-Kyle clays, gently undulating	4,589	.1	Splitro-Sawcreek sandy loams, rolling	626	( <sup>1</sup> )
Pierre-Lismas clays, rolling	30,512	1.0	Splitro-Sawcreek sandy loams, hilly	5,156	.2
Pierre-Lismas clays, hilly	62,766	2.1	Stormitt extremely stony loam, hilly	6,860	.2
Pultney-Neville association, undulating	7,660	.3	Stormitt complex, 0 to 4 percent slopes	1,952	.1
Quietus loam	3,500	.1	Stormitt complex, 4 to 15 percent slopes	379	( <sup>1</sup> )
Raynesford loam, undulating	6,455	.2	Talag clay, 0 to 8 percent slopes	4,221	.1
Reeder loam, gently undulating	1,143	( <sup>1</sup> )	Talag-Allentine complex, 0 to 4 percent slopes	3,230	.1
Reeder loam, undulating	3,846	.1	Tarrete silty clay loam, 8 to 15 percent slopes	2,648	.1
Reeder loam, hilly	2,960	.1	Terrace escarpments, gravelly	11,996	.4
Reeder-Regent complex, rolling	3,058	.1	Terrace escarpments, loamy	10,110	.3
Reeder-Rentsac complex, undulating	4,954	.2	Terry fine sandy loam, undulating	2,370	.1
Reeder-Darret association, undulating	3,536	.1	Terry-Travessilla sandy loams, undulating	516	( <sup>1</sup> )
Reeder-Darret association, rolling	2,573	.1	Teton loam, 8 to 25 percent slopes	3,486	.1
Regent silty clay loam, gently undulating	568	( <sup>1</sup> )	Teton complex, 25 to 45 percent slopes	3,262	.1
Regent silty clay loam, undulating	2,344	.1	Thedalund loam, undulating	6,431	.2
Regent silty clay loam, rolling	4,907	.2	Thedalund-Clapper complex, hilly	30,332	1.0
Renhill silty clay loam, undulating	5,243	.2	Thedalund-Cushman loams, undulating	5,028	.2
Rentsac-Doney complex, rolling	1,116	( <sup>1</sup> )	Thedalund-Fort Collins complex, rolling	46,303	1.5
Richfield silty clay loam, 0 to 2 percent slopes	1,506	.1	Thedalund-McRae loams, dissected	16,837	.5
Richfield silty clay loam, gently undulating	1,889	.1	Thedalund-Midway complex, rolling	25,897	.8
Richfield silty clay loam, undulating	2,254	.1	Thedalund-Nelson complex, rolling	8,272	.3
Richfield-Beauvais silty clay loams, gently undulating	706	( <sup>1</sup> )	Thedalund-Rock outcrop complex, hilly	56,248	1.8
Richfield-Beauvais silty clay loams, undulating	3,949	.1	Thedalund-Rock outcrop complex, very steep	5,096	.2
Riverwash	1,345	( <sup>1</sup> )	Thedalund-Travessilla loams, rolling	5,095	.2
Rock outcrop-Duncom complex, very steep	118	( <sup>1</sup> )	Thedalund-Wibaux loams, undulating	2,502	.1
Rock outcrop-Lap complex, very steep	13,974	.5	Thedalund-Wibaux complex, rolling	14,913	.5
Rock outcrop-Pultney complex, very steep	1,638	.1	Thedalund-Wibaux stony loams, hilly	51,596	1.7
Rock outcrop-Rentsac complex, rolling	1,614	.1	Thedalund-Wibaux complex, very steep	12,257	.4
Rock outcrop-Windham complex, very steep	9,664	.3	Thurlow silty clay loam, 0 to 1 percent slopes	1,291	( <sup>1</sup> )
Rottulee silt loam, gently undulating	2,178	.1	Thurlow silty clay loam, 1 to 4 percent slopes	5,094	.2
Rottulee silt loam, undulating	3,527	.1	Thurlow silty clay loam, 4 to 8 percent slopes	8,315	.3
Rottulee silt loam, rolling	3,853	.1	Thurlow-Midway silty clay loams, 4 to 15 percent slopes	51,842	1.7
Rottulee-Abac complex, rolling	3,676	.1	Toluca-Harvey complex, undulating	9,714	.3
Ryorp sandy loam, undulating	8,932	.3	Travessilla-Rock outcrop complex, rolling	1,676	.1
Saline land	5,493	.2	Travessilla-Thedalund loams, rolling	9,881	.3
Savage silty clay loam, 0 to 2 percent slopes	3,172	.1	Tullock loamy fine sand, rolling	1,841	.1
Savage silty clay loam, 2 to 4 percent slopes	2,547	.1	Twin Creek loam, 2 to 4 percent slopes	1,336	( <sup>1</sup> )
Savage silty clay loam, 4 to 8 percent slopes	3,721	.1	Twin Creek loam, 4 to 8 percent slopes	2,572	.1
Savage silty clay loam, undulating	3,707	.1	Twin Creek loam, 8 to 15 percent slopes	859	( <sup>1</sup> )
Savage silty clay loam, rolling	1,383	.1	Twin Creek-Korchea complex, 2 to 8 percent slopes	1,701	.1
Savage-Wayden silty clay loams, 4 to 15 percent slopes	2,659	.1	Vananda clay, 0 to 1 percent slopes	3,327	.1
Savage and Frazer soils, 0 to 4 percent slopes	3,208	.1	Vananda clay, 1 to 8 percent slopes	26,015	.8
			Vebar fine sandy loam, undulating	498	( <sup>1</sup> )
			Vebar fine sandy loam, rolling	1,024	( <sup>1</sup> )
			Vebar-Castner complex, undulating	1,182	( <sup>1</sup> )
			Vebar-Castner complex, rolling	1,969	.1

TABLE 1.—Approximate acreage and proportionate extent of the soils—Continued

Soil	Acres	Percent	Soil	Acres	Percent
Vebar complex, rolling	288	( <sup>1</sup> )	Windham complex, 15 to 35 percent slopes	4,897	.2
Wages loam, 0 to 2 percent slopes	552	( <sup>1</sup> )	Windham-Arnegard complex, 15 to 35 percent slopes	5,566	.2
Wages loam, 2 to 4 percent slopes	3,249	.1	Windham-Norbert complex, 15 to 50 percent slopes	6,948	.2
Wages loam, 4 to 8 percent slopes	5,671	.2	Windham-Wayden complex, 15 to 35 percent slopes	5,244	.2
Wayden silty clay loam, rolling	11,456	.4	Windham-Lap association, very steep	20,762	.7
Wayden silty clay loam, hilly	13,452	.4	Winnett complex, undulating	1,507	.1
Wayden-Arnegard complex, hilly	5,346	.2	Xavier silty clay loam, gently undulating	1,256	( <sup>1</sup> )
Wayden-Grail complex, hilly	7,178	.2	Xavier silty clay loam, undulating	2,381	.1
Wayden-Judith silty clay loams, hilly	4,499	.1	Xavier silty clay loam, rolling	672	( <sup>1</sup> )
Wayden-Regent silty clay loams, hilly	29,305	.9	Xavier-Shaak complex, undulating	693	( <sup>1</sup> )
Wayden-Savage silty clay loams, rolling	13,669	.4	Xavier-Shaak complex, rolling	1,116	( <sup>1</sup> )
Wayden-Rock outcrop complex, rolling	3,220	.1	Gravel pits	236	( <sup>1</sup> )
Wayden-Rock outcrop complex, hilly	12,185	.4	Water	105	( <sup>1</sup> )
Wayden-Shale outcrop complex, very steep	3,848	.1			
Wayden complex, hilly	8,534	.3			
Wibaux loam, hilly	12,169	.4			
Wibaux-Spearman complex, rolling	21,101	.7			
Windham cobbly loam, 15 to 35 percent slopes	6,658	.2	Total	3,042,595	100.0

<sup>1</sup> Less than 0.05 percent.

cause the second letter of the map symbol is capitalized; the second letter of medium-intensity units is not capitalized.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (10).<sup>1</sup>

### Abac Series

The Abac series consists of shallow, rolling to very steep, well-drained soils on red shale and sandstone uplands. Slopes range from 8 to 50 percent. These soils formed in material weathered from the underlying fine-grained sandstone and silty shale. Elevation ranges from 4,000 to 6,000 feet.

The native vegetation is mainly bluebunch wheatgrass, prairie junegrass, green needlegrass, western wheatgrass, Hoods phlox, and fringed sagewort. Where snow accumulates, vegetation includes wild plum, snowberry, thornapple, and roses. Annual precipitation is 15 to 17 inches, the average annual soil temperature is 44° to 47° F, and the frost-free period is 90 to 105 days.

In a representative profile the surface layer is reddish-brown silt loam about 3 inches thick. The underlying material is red loam and gravelly loam and light reddish-brown very gravelly loam. It averages about 30 percent semihard shale fragments. Red platy shale and sandstone begin at a depth of about 1½ inches.

Permeability is moderate, and available water capacity is very low. The effective rooting depth is about 20 inches. Most of these soils are used for range, recreation, watershed, and wildlife. In places they are used for crops.

Representative profile of Abac loam, rolling, in grassland, approximately 1,950 feet east and 200 feet north of the SW. corner sec. 29, T. 5 S., R. 30 E.

A1—0 to 3 inches, reddish-brown (2.5YR 5/4) silt loam, dark reddish brown (2.5YR 3/4) moist; moderate, thin, platy structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; moderately effervescent; few soft, red shale fragments; clear, smooth boundary.

C1—3 to 8 inches, red (2.5YR 5/6) loam, dark-red (2.5YR 3/6) moist; weak, medium, prismatic structure; hard, friable, sticky and plastic; common very fine roots; many fine tubular pores; 15 percent (volume) soft shale fragments; moderately effervescent; clear, wavy boundary.

C2—8 to 15 inches, red (2.5YR 5/6) gravelly loam, dark red (2.5YR 3/6) moist; fine, blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine roots and pores; 30 percent (volume) soft shale fragments; moderately effervescent; common fine lime threads; clear, wavy boundary.

C3—15 to 19 inches, light reddish-brown (2.5YR 6/4) very gravelly loam, red (2.5YR 4/6) moist; massive; hard, friable, slightly sticky and slightly plastic; a few mats of very fine roots follow the bedding planes of the shale; 60 percent (volume) soft shale fragments; strongly effervescent; few fine lime threads; abrupt, irregular boundary.

C4—19 to 26 inches, red platy shale and fine-grained sandstone; calcareous.

Depth to shale or soft sandstone ranges from 6 to 20 inches. Coarse fragments of shale, sandstone, and, in places, limestone make up 15 to 35 percent, by volume, of the soil. The soil material is generally loam or very fine sandy loam and, in places, silt loam. The A1 horizon ranges from reddish brown to weak red when dry. The C horizon ranges from light reddish brown to weak red and red.

**Abac loam, rolling (Aa).**—This soil is on dissected shale uplands that are made up of multiple ridges and hills. Slopes are 8 to 15 percent. Generally, this soil is in a band below hilly Abac soils. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of Peritsa, Twin Creek, and Fergus soils that make up 15 to 25 percent of the area of this mapping unit.

Runoff is medium, and the hazard of erosion is severe. This soil is used mostly for range, wildlife, recreation, and watershed. Small areas of this soil in-

<sup>1</sup> Italic numbers in parentheses refer to Literature Cited, p. 222.



cluded with deep soils are used for dryfarmed crops. Capability unit VIe-1 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 3M.

**Abac loam, hilly (AB).**—This soil is on deeply dissected shale uplands that are made up of high, isolated hills and ridges. Slopes are mostly 15 to 35 percent, but in places they are as much as 40 percent. The soil has a profile similar to the one described as representative of the series, but it is steeper.

Included with this soil in mapping are areas of Fergus and Peritsa soils that are covered with snowberry, chokecherry, and wild plum. Shale and sandstone outcrops are on south-facing and east-facing slopes of steep hills and valley rims in places. These included soils and outcrops make up 10 to 20 percent of the area of this mapping unit.

Runoff is rapid, and the hazard of erosion is severe. This soil is used for range, watershed, recreation, and wildlife. Capability unit VIe-1 dryland; Thin Hilly range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**Abac-Bitton complex, hilly (AC).**—This complex is made up of steep and hilly soils on deeply dissected gravelly benches and terraces underlain by sedimentary shale bedrock. It is about 70 percent Abac soil and 30 percent Bitton soil. The Abac soil is on the lower two-thirds of valley sides where slopes are 20 to 35 percent. The Bitton soil is in bands, 75 to 150 feet wide, that extend from the rim downward on valley sides where slopes are 15 to 20 percent. The Abac soil in this complex has a profile similar to the one described as representative of the Abac series, but it has a few limestone, quartzite, and gneiss fragments of pebble size on the surface. The Bitton soil has a profile similar to the one described as representative of the Bitton series, but it has limestone gravel, more flour lime, and predominantly pink and reddish-brown underlying material. Included in mapping are small bands of Peritsa soils.

Runoff is medium, and the hazard of erosion is severe. These soils are used for range, watershed, recreation, and wildlife. The Bitton soil is a source of road gravel in places. Capability unit VIe-1 dryland; Thin Hilly range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**Abac-Rock outcrop complex, very steep (AD).**—This complex is made up of very steep soils on sedimentary uplands. It is 60 to 85 percent Abac loam and 15 to 40 percent Rock outcrop. Areas of this complex consist of several rock ledges, 5 to 30 feet thick, in a staircase pattern on the sides of deep valleys or high hills. The Abac soil is on hilltops and steep sides of hills and valleys between areas of Rock outcrop. It has slopes of mostly 35 to 50 percent. Rock outcrop has slopes that range from 50 to 95 percent. The Abac soil in this complex has a profile similar to the one described as representative of the Abac series, but it is steeper.

Runoff is rapid, and the hazard of erosion is severe. These soils are used for range, watershed, recreation, and wildlife. Capability unit VIIe-1 dryland; Thin Breaks range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

## Absarokee Series

The Absarokee series consists of moderately deep, gently sloping to steep and gently undulating to hilly, well-drained soils on sedimentary uplands. Slopes are mostly 2 to 35 percent, but they range to 1 percent. These soils formed in material weathered from the underlying hard, mixed sandstone and shale. Elevation ranges from 3,800 to 4,400 feet.

The native vegetation is mainly western wheatgrass, green needlegrass, Idaho fescue, broom snakeweed, fringed sagewort, and Japanese brome. Annual precipitation is 14 to 16 inches, the average annual soil temperature is 44° to 46° F, and the frost-free period is 100 to 115 days.

In a representative profile the surface layer is grayish-brown and dark grayish-brown silt loam and silty clay loam about 6 inches thick. The subsoil is silty clay loam, silty clay, and clay about 18 inches thick. It is dark grayish brown and brown in the upper part and pale brown and light yellowish brown in the lower part. The substratum is pale-yellow clay. Shale and sandstone are at a depth of 31 inches.

Permeability is moderately slow, and available water capacity is low. The effective rooting depth is about 36 inches. These soils are used for dryfarmed crops, wildlife, watershed, recreation, and range.

Representative profile of Absarokee silty clay loam, undulating, in grassland, approximately 1,800 feet south and 400 feet west of the NE. corner sec. 17, T. 4 S., R. 28 E.

- A11—0 to 2 inches, grayish-brown (10YR 5/2) heavy silt loam, very dark brown (10YR 2/2) moist; moderate, thin, platy structure; hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; clear, smooth boundary.
- A12—2 to 6 inches, dark grayish-brown (10YR 4/2) light silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, prismatic structure parting to weak, medium, blocky; hard, friable, sticky and plastic; many very fine and micro roots; common very fine pores; gradual, wavy boundary.
- B1—6 to 10 inches, dark grayish-brown (10YR 4/2) silty clay loam, dark brown (10YR 3/3) moist; strong, medium, prismatic structure parting to moderate, medium, blocky; very hard, firm, very sticky and very plastic; many very fine roots; many very fine pores; clear, wavy boundary.
- B21t—10 to 17 inches, brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; strong, medium, prismatic structure parting to strong, medium, blocky; very hard, very firm, very sticky and very plastic; common very fine roots; common very fine pores; moderately thick, patchy clay films on peds; clear, wavy boundary.
- B22t—17 to 20 inches, pale-brown (10YR 6/3) light silty clay, dark yellowish brown (10YR 4/4) moist; moderate, medium, prismatic structure parting to moderate, medium and fine, blocky; very hard, firm, very sticky and very plastic; common very fine roots; many very fine pores; moderately thick, patchy clay films on peds; clear, wavy boundary.
- B3ca—20 to 24 inches, light yellowish-brown (2.5Y 6/4) silty clay loam, light olive brown (2.5Y 5/4) moist; weak, medium, prismatic structure parting to moderate, medium, blocky; hard, friable, sticky and plastic; strongly effervescent; few very fine roots; many very fine pores; common fine and medium, soft masses of lime; clear, wavy boundary.
- Cca—24 to 31 inches, pale-yellow (2.5Y 7/4) clay, light yellowish brown (2.5Y 6/4) moist; moderate,



coarse, blocky structure; very hard, firm, very sticky and very plastic; few very fine roots; strongly effervescent; clear, wavy boundary.

R—31 to 33 inches, hard platy sandstone and shale.

Depth to bedrock ranges from 20 to 40 inches, and depth to calcareous material, from 12 to 24 inches. The A horizon ranges from grayish-brown to dark grayish-brown loam to silty clay loam. The B2t horizon is clay or silty clay that ranges from brown to dark yellowish brown when dry. The Cca horizon is light yellowish brown to pale yellow.

**Absarokee silty clay loam, gently undulating (Ae).**—This soil is on smooth, high sedimentary uplands. Slopes are mostly 2 to 4 percent, but they range to 1 percent. The soil has a profile similar to the one described as representative of the series, but it is less sloping. Included in mapping are spots of Rock outcrop and Amherst channery clay loam.

Runoff is slow, and the hazard of erosion is slight. This soil is used for dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIe-2 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 2M.

**Absarokee silty clay loam, undulating (Af).**—This soil is on shale uplands at the heads and along the edges of deep drainageways. Slopes are mostly 4 to 6 percent, and they are 200 to 300 feet long. The soil has the profile described as representative of the series. Included in mapping are small spots of Lennep loam and Maginnis channery loam.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIIe-2 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 2M.

**Absarokee silty clay loam, rolling (Ag).**—This soil is on dissected sedimentary uplands. The landscape consists of rounded, narrow ridges between deep, narrow drainageways. Slopes are mostly 8 to 10 percent, but they range to 15 percent. Slopes range from 75 to 200 feet long. The soil has a profile similar to the one described as representative of the series, but it is steeper.

Included with this soil in mapping are small spots of Amherst channery loam, a few areas of soils that have bedrock at a depth of less than 20 inches, areas of Absarokee soils that have coarse fragments throughout, and areas of soils that have a surface covered with coarse sandstone fragments.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for watershed, recreation, wildlife, range, hay, and dryfarmed crops. Capability unit IVe-2 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 2M.

**Absarokee silty clay loam, hilly (AH).**—This soil is on ridges and hills in the sedimentary uplands. Slopes are mostly 20 to 30 percent, but they range from 15 to 35 percent. Slopes range from 200 to 400 feet long. In places they are broken by a low rock ledge that leaves scattered boulders of conglomerate and hard sandstone on the surface. The soil has a profile similar to the one described as representative of the series, but it is steeper and is underlain by semihard shale.

Included with this soil in mapping are small areas of Reeder, Castner, and Regent soils that make up 10 to 25 percent of the area of this mapping unit. The Reeder and Regent soils are on smooth hilltops or at

the lower end of long foot slopes. The Castner soil is around rock ledges and valley rims.

Runoff is rapid, and the hazard of erosion is severe. This soil is used for range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Thin Hilly range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**Absarokee-Castner complex, undulating (Ak).**—This complex is made up of undulating soils on sedimentary uplands. It is 50 to 70 percent Absarokee loam, 20 to 35 percent Castner loam, and 5 to 15 percent Rock outcrop. The Castner soil is typically in a band around the Rock outcrop. Slopes are mostly 4 to 8 percent, but they range to 2 percent. In places spots as large as 5 acres are entirely free of Rock outcrop. The Absarokee soil in this complex has a profile similar to the one described as representative of the Absarokee series, but the surface layer is loam.

Runoff is medium, and the hazard of erosion is slight. These soils are used for range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Shallow range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**Absarokee-Castner complex, hilly (AL).**—This complex is made up of hilly soils in the sedimentary uplands. It is 55 to 70 percent Absarokee loam and 25 to 40 percent Castner loam. Slopes are mostly 15 to 35 percent, but they range to 8 percent. The Absarokee soil is on smooth tops and sides of hills. The Castner soil is around the areas of Rock outcrop included in this unit. The Absarokee soil in this complex has a profile similar to the one described as representative of the Absarokee series, but it is steeper and has a surface layer of loam. Included in mapping are some areas of Wayden and Armington soils.

Runoff is rapid, and the hazard of erosion is moderate to severe. These soils are used for range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Thin Hilly range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**Absarokee-Armington association, gently sloping (AM).**—This association is made up of gently sloping soils on sedimentary uplands. Slopes are mostly 4 to 8 percent, but they range to 2 percent. The association is about 55 percent Absarokee silty clay loam and 35 percent Armington silty clay loam. The soils are in shallow valleys below rock ledges. The two major soils are intermixed, but the red and pink Armington soil is easy to identify. The Armington soil in this complex has a profile similar to the one described as representative of the Armington series, but it has many medium and coarse, soft masses of segregated lime in the substratum.

Included with these soils in mapping are areas of Reeder and Regent soils on the steeper knolls and spur ridges. Also included are areas of Rock outcrop. These inclusions make up about 10 percent of this unit.

Runoff is medium, and the hazard of erosion is moderate. These soils are used for dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIIe-2 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 2M.

## Absher Series

The Absher series consists of deep, nearly level and gently sloping, well-drained, alkali-affected soils on terraces, fans, and sedimentary uplands. Slopes range from 1 to 4 percent. These soils formed in mixed clay and clay loam alluvium. Elevation ranges from 3,600 to 4,200 feet.

The native vegetation is western wheatgrass, prairie junegrass, cheatgrass, and Sandberg bluegrass. Annual precipitation is 14 to 16 inches, the average annual soil temperature is 45° to 47° F, and the frost-free period is about 110 days.

In a representative profile the surface layer is light brownish-gray loam and clay about 5 inches thick. The subsoil is light brownish-gray and light olive-gray clay about 17 inches thick. The substratum is olive and olive-gray clay loam and sandy clay loam that extends to a depth of 62 inches or more.

Permeability is very slow in the subsoil, and available water capacity is moderate or high. The effective rooting depth is 60 inches or more. These soils are used for range, wildlife, recreation, and watershed.

Representative profile of Absher clay in an area of Absher-Nobe clays, in grassland, 1,320 feet south and 750 feet east of the NW. corner sec. 15, T. 8 S., R. 33 E.

- A21—0 to 3 inches, light brownish-gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; weak, thin, platy structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; clear, smooth boundary.
- A22—3 to 5 inches, light brownish-gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate, thin, platy structure; hard, friable, slightly sticky and plastic; many very fine roots and pores; abrupt, smooth boundary.
- B21t—5 to 10 inches, light brownish-gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; strong, medium, prismatic structure; extremely hard, very firm, very sticky and very plastic; common very fine roots; very fine pores; moderately thick, patchy clay films on peds; light-gray, clean sand grains coating upper 2 inches of prisms; abrupt, smooth boundary.
- B22t—10 to 14 inches, light brownish-gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate, medium, prismatic structure parting to strong, fine and medium, blocky; extremely hard, very firm, very sticky and very plastic; many very fine roots; moderately thick, continuous clay films on peds; clear, wavy boundary.
- B3cacs—14 to 22 inches, light olive-gray (5Y 6/2) light clay, olive (5Y 4/3) moist; weak, medium, prismatic structure parting to moderate, medium, blocky; very hard, firm, very sticky and very plastic; common very fine roots; slightly effervescent; common fine, soft lime masses; few fine gypsum crystals; gradual, wavy boundary.
- C1cacs—22 to 29 inches, olive (5Y 5/3) clay loam, olive (5Y 4/3) moist; moderate, coarse, blocky structure; very hard, friable, sticky and plastic; few fine roots; slightly effervescent; many fine and medium, soft lime masses; few fine gypsum crystals; gradual, wavy boundary.
- C2—29 to 39 inches, olive-gray (5Y 5/2) heavy clay loam, olive (5Y 4/3) moist; massive; very hard, firm, very sticky and plastic; slightly effervescent; common fine, soft lime masses; clear, wavy boundary.
- C3—39 to 62 inches, olive-gray (5Y 5/2) sandy clay loam, olive (5Y 4/3) moist; massive; hard, firm, sticky and plastic; slightly effervescent.

Depth to segregated lime ranges from 12 to 36 inches, and depth to gypsum, from 12 to 20 inches. The B2t horizon ranges from olive to light yellowish brown when dry. It is 40 to 55 percent clay. The C3 horizon below a depth of about 40 inches in places has thin layers of loam, sandy loam, and silt.

**Absher-Nobe clays (An).**—This complex is made up of nearly level and gently sloping soils on terraces and fans in the sedimentary uplands. It is 60 to 75 percent Absher clay and 20 to 30 percent Nobe clay. Slopes are 1 to 4 percent. Areas range from 10 to 60 acres in size. The Nobe soil is in 5- to 8-inch microdepressions.

Included with these soils in mapping in the areas of Absher soil are small areas of a soil that is underlain by shale bedrock at a depth of 40 to 60 inches. Also included are small spots of Lennep loam and Marias clay.

Runoff is medium, and the hazard of erosion is slight. These soils are used for range, wildlife, and recreation. Capability unit VIs-1 dryland; Pan Spots range site, 15- to 19-inch precipitation zone; wind-break suitability group 3S.

## Adel Series

The Adel series consists of deep, sloping, well-drained soils on foot slopes on the upper sides of mountain valleys. Slopes are mostly 4 to 8 percent, but they range to 15 percent. These soils formed in loamy alluvium derived from mixed sandstone and shale. Elevation ranges from 4,000 to 6,000 feet.

The native vegetation is mainly mountain brome grass, rough fescue, wild geranium, horsemint, snowberry, big sagebrush, and wild rose. Annual precipitation is 18 to 22 inches, the average annual soil temperature is 39° to 44° F, and the frost-free period is 60 to 70 days.

In a representative profile the surface layer is dark grayish-brown loam about 8 inches thick. The subsoil is dark grayish-brown and pale-brown loam and clay loam about 32 inches thick. Red clay shale is at a depth of about 40 inches.

Permeability is moderate, and available water capacity is moderate or high. The effective rooting depth is 40 inches or more. These soils are used for range, watershed, recreation, and summer game range.

Representative profile of Adel loam in an area of Adel-Mayflower association, sloping, in grassland, 2,640 feet north and 1,320 feet west of the SE. corner sec. 29, T. 6 S., R. 26 E.

- A11—0 to 4 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/1) moist; moderate, medium, crumb structure; soft, friable, non-sticky and slightly plastic; many fine and very fine roots; clear, smooth boundary.
- A12—4 to 8 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak, coarse, prismatic structure parting to moderate, coarse, crumb; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; clear, wavy boundary.
- B1—8 to 14 inches, dark grayish-brown (10YR 4/2) loam, dark brown (10YR 3/2) moist; weak, coarse, prismatic structure parting to weak, medium, blocky; hard, friable, sticky and plastic; common fine and very fine roots; clear, wavy boundary.
- B21—14 to 19 inches, pale-brown (10YR 5/3) clay loam, dark yellowish brown (10YR 3/4) moist; moderate, coarse, prismatic structure parting to mod-



erate, coarse, blocky; hard, friable, sticky and plastic; common fine and very fine roots; thin clay bridgings between sand grains; clear, wavy boundary.

B22—19 to 23 inches, pale-brown (10YR 5/3) clay loam, dark yellowish-brown (10YR 3/4) moist; moderate, coarse, prismatic structure parting to moderate, medium and coarse, blocky; hard, friable, sticky and plastic; common fine and very fine roots; gradual, wavy boundary.

B23—23 to 26 inches, pale-brown (10YR 5/3) clay loam, brown (10YR 5/3) moist; moderate, coarse, prismatic structure parting to moderate, medium, blocky; hard, firm, sticky and plastic; few fine and medium roots; many medium pores; gradual, wavy boundary.

B24—26 to 40 inches, pale-brown (10YR 5/3) clay loam, brown (10YR 5/3) moist; weak, medium, prismatic structure parting to weak, medium, blocky; hard, firm, sticky and plastic; few fine and medium roots; many medium and coarse pores; clear, wavy boundary.

C—40 to 47 inches, red clay shale.

The dark grayish-brown A and B horizons range from 14 to 40 inches in combined thickness. The material between depths of 10 and 40 inches is loam or clay loam. Depth to pink and red shale is more than 40 inches. The A1 horizon and the upper part of the B2 horizon are dark brown, brown, grayish brown, and pale brown.

**Adel-Mayflower association, sloping (AO).**—This association is made up of soils on hillsides above sheer limestone walls. It is about 70 percent Adel loam and 30 percent Mayflower silt loam. Slopes are mostly 4 to 8 percent, but they range to 15 percent. In places the soils are below the sandstone ridges. The Adel soil in this association has the profile described as representative of the Adel series. Included in mapping are small seeps and springs that have a cover of aspen trees.

Runoff is rapid, and the hazard of erosion is moderate. These soils are used for range, wildlife, recreation, watershed, and pasture. Capability unit IVE-2 dryland; Silty range site, 20- to 24-inch precipitation zone; windbreak suitability group 1.

## Adger Series

The Adger series consists of deep, nearly level to sloping and gently undulating and undulating, well-drained, sodium-affected soils on fans, foot slopes, terraces, and shale uplands. Slopes range from 0 to 8 percent. These soils formed in clay alluvium. Elevation ranges from 3,700 to 4,500 feet.

The native vegetation is mainly western wheatgrass, big sagebrush, Sandberg bluegrass, rubber rabbitbush, and western yarrow. Annual precipitation is 14 to 16 inches, the average annual soil temperature is 46° to 47° F, and the frost-free period is 110 to 120 days.

In a representative profile the surface layer is light brownish-gray loam about 1 inch thick. The subsoil is dark grayish-brown, grayish-brown, and light yellowish-brown clay, about 17 inches thick, that is very hard when dry. The substratum is light yellowish-brown silty clay that extends to a depth of 60 inches or more.

Permeability is slow, and available water capacity is moderate or high. The effective rooting depth is 60 inches or more. These soils are used mainly for range,

wildlife, recreation, and watershed, but a few small areas are used for dryfarmed crops.

Representative profile of Adger clay, 0 to 8 percent slopes, in grassland, 2,640 feet south and 100 feet east of the NW. corner sec. 21, T. 8 S., R. 33 E.

A2—0 to 1 inch, light brownish-gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; moderate, thin, platy structure; hard, friable, slightly sticky and slightly plastic; many very fine roots; abrupt, smooth boundary.

B21t—1 inch to 6 inches, dark grayish-brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate, medium, prismatic structure parting to weak, medium and fine, blocky; very hard, very firm, very sticky and very plastic; common very fine roots; many clean sand grains coating the tops of the prisms; clear, wavy boundary.

B22t—6 to 10 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate, fine and medium, blocky structure; very hard, very firm, very sticky and very plastic; few very fine roots; common very fine tubular pores; slightly effervescent; clear, wavy boundary.

B3cs—10 to 18 inches, light yellowish-brown (2.5Y 6/4) clay, dark grayish brown (2.5Y 4/2) moist; strong, medium and fine, blocky structure; very hard, very firm, very sticky and very plastic; few roots; common very fine tubular pores; slightly effervescent; common fine and medium gypsum crystals; clear, wavy boundary.

C1—18 to 29 inches, light yellowish-brown (2.5Y 6/4) silty clay, dark grayish brown (2.5Y 4/2) moist; weak, medium, blocky structure; very hard, firm, very sticky and plastic; few roots; common very fine tubular pores; strongly effervescent; common fine and medium threads and soft masses of lime; gradual, wavy boundary.

C2—29 to 60 inches, light yellowish-brown (2.5Y 6/4) silty clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, very sticky and plastic; strongly effervescent; few fine threads and soft masses of lime.

Depth to the horizon of gypsum accumulation ranges from 10 to 18 inches. The A2 horizon ranges from light gray to light brownish gray when dry. The B2t and Bcs horizons are 50 to 60 percent clay. They range from light yellowish brown to grayish brown when dry.

**Adger clay, 0 to 8 percent slopes (Ap).**—This soil is on fans and terraces and shale hills that are partly covered by windblown alluvium. Areas are 10 to 15 acres in size. Slopes are 0 to 2 percent on the terraces, 2 to 4 percent on the fans, and 2 to 8 percent on the hills. Included in mapping are small areas of Lennep loam and Nobe clay.

Runoff is moderate, and the hazard of erosion is slight. This soil is used for range, wildlife, recreation, and watershed. Capability unit VI-1 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 3S.

## Alice Series

The Alice series consists of deep, gently sloping and strongly sloping and rolling, well-drained soils on narrow foot slopes, fans, and valley bottoms. Slopes range from 4 to 15 percent. These soils formed in sandy alluvium derived from calcareous sandstone. Elevation ranges from 2,900 to 3,700 feet.

The native vegetation is green sagewort, little blue-stem, prairie sandreed, side-oats grama, blue grama, broom snakeweed, ragweed, and eriogonum. Annual

precipitation is 13 to 14 inches, the average annual soil temperature is 47° to 49° F, and the frost-free period is 115 to 125 days.

In a representative profile the surface layer is grayish-brown fine sandy loam about 2 inches thick. The subsoil is grayish-brown and light olive-brown sandy loam about 10 inches thick. The substratum is light olive-brown, light yellowish-brown, and pale-yellow sandy loam and loamy sand that extends to a depth of 65 inches or more.

Permeability is moderately rapid, and available water capacity is moderate. The effective rooting depth is 60 inches or more. Most of these soils are used for range, wildlife, recreation, and watershed. Small areas are used for dryfarmed hay.

Representative profile of Alice fine sandy loam, 4 to 15 percent slopes, in grassland, 990 feet east and 330 feet south of the NW. corner sec. 2, T. 1 S., R. 35 E.

- A—0 to 2 inches, grayish-brown (2.5Y 5/2) fine sandy loam, very dark grayish brown (2.5Y 3/2) moist; weak, coarse, crumb structure parting to single grained; soft, very friable, nonsticky and slightly plastic; many fine and very fine roots; clear, smooth boundary.
- B21—2 to 6 inches, grayish-brown (2.5Y 5/2) sandy loam, very dark grayish brown (2.5Y 3/2) moist; moderate, coarse, prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; gradual, wavy boundary.
- B22—6 to 12 inches, light olive-brown (2.5Y 5/4) sandy loam, olive brown (2.5Y 4/4) moist; massive; slightly hard, friable, nonsticky and slightly plastic; common fine roots; gradual, wavy boundary.
- C1—12 to 17 inches, light olive-brown (2.5Y 5/4) light sandy loam, olive brown (2.5Y 4/4) moist; massive; slightly hard, friable, nonsticky and slightly plastic; few very fine roots; slightly effervescent; clear, smooth boundary.
- C2—17 to 28 inches, light yellowish-brown (2.5Y 6/4) light sandy loam, light olive brown (2.5Y 5/4) moist; massive; hard, friable, nonsticky and slightly plastic; few very fine roots; slightly effervescent; few fine, soft lime masses; gradual, wavy boundary.
- C3—28 to 41 inches, light yellowish-brown (2.5Y 6/4) light sandy loam, light olive brown (2.5Y 5/4) moist; massive; slightly hard, friable, nonsticky and slightly plastic; few very fine roots; slightly effervescent; gradual, wavy boundary.
- C4—41 to 65 inches, pale-yellow (2.5Y 7/4) heavy loamy sand, olive (2.5Y 4/4) moist; massive; slightly hard, very friable; nonsticky and slightly plastic; slightly effervescent.

The A horizon ranges from dark grayish-brown to light olive-brown sandy loam or fine sandy loam. The B2 horizon ranges from 5 to 10 inches in thickness. It is 12 to 18 percent clay.

**Alice fine sandy loam, 4 to 15 percent slopes (Ar).**—This soil is on foot slopes, fans, and valley bottoms in 20- to 30-acre areas. Slopes are smooth, and they are mostly 4 to 10 percent. Steeper slopes occur below the higher hills and the residual soils that border the deep valleys. Slopes are 200 to 400 feet long.

Included with this soil in mapping are small areas of Olney fine sandy loam on large fans. Also included are narrow bands, 50 to 75 feet wide, of Glenberg fine sandy loam below the sandstone ledges.

Runoff is slow, and the hazard of soil blowing is severe. This soil is used for range, hay, wildlife, recre-

ation, watershed, and dryfarmed crops. Capability unit IIIe-3 dryland; Sandy range site, 10- to 14-inch precipitation zone; windbreak suitability group 2M.

### Allentine Series

The Allentine series consists of deep, nearly level to sloping, well-drained soils on broad fans, ridgetops, and terraces and in stream bottoms. Slopes range from 0 to 8 percent. These soils formed in clayey alluvium. Elevation ranges from 2,700 to 3,300 feet.

The native vegetation is mainly western wheatgrass, prairie junegrass, green needlegrass, big sagebrush, curlycup gumweed, and greasewood. Annual precipitation is 12 to 13 inches, the average annual soil temperature is 47° to 49° F, and the frost-free period is 115 to 125 days.

In a representative profile the surface layer is light-gray silt loam about 2 inches thick. The subsoil is grayish-brown and light brownish-gray clay about 25 inches thick. The substratum is pale-olive and light-olive gray clay and silty clay that extends to a depth of 60 inches or more.

Permeability is very slow, and available water capacity is moderate or high. The effective rooting depth is 60 inches or more. These soils are used for range, wildlife, recreation, watershed, and irrigated and dryfarmed crops.

Representative profile of Allentine clay, 0 to 2 percent slopes, in grassland, 1,980 feet south and 300 feet east of the NW. corner sec. 30, T. 1 S., R. 32 E.

- A2—0 to 2 inches, light-gray (2.5Y 7/2) silt loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; many fine and few medium roots; many vesicular pores; abrupt, smooth boundary.
- B1—2 to 4 inches, grayish-brown (2.5Y 5/2) light clay, dark grayish brown (2.5Y 4/2) moist; weak, medium, prismatic structure parting to moderate, fine, blocky; very hard, very sticky and very plastic; many fine and few medium roots; clear, smooth boundary.
- B21t—4 to 9 inches, grayish-brown (2.5Y 5/2) heavy clay, dark grayish brown (2.5Y 4/2) moist; moderate, coarse, prismatic structure parting to strong, fine, blocky; extremely hard, very firm, very sticky and very plastic; common very fine and fine roots; thin, continuous and patchy, thick clay films on peds; clear, smooth boundary.
- B22t—9 to 20 inches, light brownish-gray (2.5Y 6/2) heavy clay, dark grayish brown (2.5Y 4/2) moist; weak, medium, blocky structure; extremely hard, very firm, very sticky and very plastic; common fine and very fine roots; thin, patchy clay films on peds; strongly effervescent; few fine lime mottles; gradual, wavy boundary.
- B3—20 to 27 inches, light brownish-gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; weak, coarse, blocky structure; extremely hard, very firm, very sticky and very plastic; few fine and very fine roots; strongly effervescent; few fine lime mottles; gradual, wavy boundary.
- C1cs—27 to 34 inches, pale-olive (5Y 6/3) clay, olive (5Y 4/3) moist; weak, coarse, blocky structure; extremely hard, very firm, very sticky and very plastic; few fine and very fine roots; strongly effervescent; few medium gypsum and salt crystals; gradual, wavy boundary.
- C2cs—34 to 48 inches, pale-olive (5Y 6/3) silty clay, olive (5Y 4/3) moist; massive; very hard, firm, very sticky and very plastic; few fine and very fine



roots; strongly effervescent; common fine gypsum and salt crystals; gradual, wavy boundary.  
C3—48 to 60 inches, light olive-gray (5Y 6/2) clay, olive (5Y 4/3) moist; massive; very hard, firm, very sticky and very plastic; few fine pebbles; strongly effervescent; few coarse gypsum and lime mottles.

Depth to lime ranges from 8 to 12 inches, and depth to gypsum, from 12 to 30 inches. The B2t horizon is clay or silty clay loam.

**Allentine clay, 0 to 2 percent slopes (Asa).**—This soil is in valley bottoms and on terraces. Areas range from 10 to 30 acres in size. The soil has the profile described as representative of the series. Included in mapping are small areas of Bone clay and Vananda clay.

Runoff is slow, and the hazard of erosion is slight. This soil is used mainly for range, recreation, and wildlife, but small areas are used for hay and irrigated crops. Capability unit VIs-1 dryland, IVs-1 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 2S.

**Allentine clay, 2 to 4 percent slopes (Asb).**—This gently sloping soil is on fans, at the heads of drainageways, and on wide ridgetops. Slopes are mostly 2 or 3 percent and range from 150 to 350 feet long. The soil has a profile similar to the one described as representative of the series, but it is steeper.

Included with this soil in mapping are small areas of a soil that is underlain by clay shale at a depth of 40 to 60 inches and small spots of Pierre clay.

Runoff is medium, and the hazard of erosion is slight. This soil is used mainly for range, recreation, and wildlife, but small areas are used for hay and irrigated crops. Capability unit VIs-1 dryland, IVs-1 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 2S.

**Allentine-Bone complex, 0 to 1 percent slopes (Asc).**—This complex is made up of nearly level soils on fans and terraces. It is 55 to 65 percent Allentine silty clay loam, 15 to 30 percent Bone silty clay, and about 10 percent Vananda clay. The soils are intermixed. The land surface is uneven. The Bone soil is in 3- to 6-inch microdepressions. The soils in this complex have profiles similar to the ones described as representative of their respective series, but there are a few pebbles on the surface.

Runoff is slow, and the hazard of erosion is slight. These soils are used for range, wildlife, and recreation. They are suitable for some irrigated crops and hay. Capability unit VIs-1 dryland, IVs-1 irrigated; Pan Spots range site, 10- to 14-inch precipitation zone; windbreak suitability group 3S.

**Allentine-Bone complex, 1 to 4 percent slopes (Asd).**—This complex is made up of nearly level and gently sloping soils on fans and narrow terraces. It is about 60 percent Allentine silty clay loam, 30 percent Bone silty clay, and 10 percent Vananda silty clay. Slopes are mostly less than 3 percent. The Bone soil is in 2- to 6-inch microdepressions. The soils in this complex have profiles similar to the ones described as representative of their respective series, but there are a few pebbles on the surface.

Runoff is medium, and the hazard of erosion is slight. These soils are used for range, wildlife, and recreation. Capability unit VIs-dryland; Pan Spots

range site, 10- to 14-inch precipitation zone; windbreak suitability group 3S.

## Alluvial Land

Three units of Alluvial land are mapped in the Area. They are described in the following paragraphs.

**Alluvial land, gravelly (ATa).**—These are gravelly soils in narrow valleys and on gravel bars on the river flood plain. Runoff and stream flooding are active in mixing and changing the material yearly. Slopes range from 0 to 4 percent. The material ranges from sand and loamy sand to very gravelly sand and sandy gravel. In places there is a 6- to 10-inch surface layer of loam, sandy loam, and gravelly loam over the loose material.

Runoff is very slow, and the hazard of erosion and flooding is severe. Alluvial land, gravelly, is used for range, wildlife, and recreation. Capability unit VIs-1 dryland; Shallow to Gravel range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

**Alluvial land, cobbly (ATb).**—These are very stony, gravelly, and cobbly silt loam and loam alluvium soils on flood plains, in valley bottoms, and on fans in mountain valleys. Areas are generally less than 300 feet wide and have a single stream channel or a braided system of several shallow channels on the valley bottom. The single channel generally has perpendicular sides and is actively eroding, and the braided channels are vegetated. Some small terraces are included in the areas where tributary drainageways empty into main valleys. Slopes are 0 to 1 percent on the channel bottoms and the flood plains and 3 or 4 percent on the sides of the braided channels. Stream channels are cut 2 to 5 feet below the level of the flood plain. About 30 percent of the land surface is covered with coarse fragments of stone, gravel, and cobble size. The amount of coarse fragments in the alluvium ranges from 25 to 75 percent. Depth to loose material ranges from 0 to 24 inches.

Runoff is slow, and the hazard of erosion is severe. Flooding is frequent. Alluvial land, cobbly, is used mainly for range, wildlife, and recreation. Capability unit VIs-1 dryland; Shallow to Gravel range site, 15- to 19-inch precipitation zone; windbreak suitability group 3M.

**Alluvial land, wet (ATc).**—These are nonsaline mixed loam, silt loam, and silty clay loam alluvium soils in major perennial stream valleys. The stream channels are cut 2 to 5 feet below the level of the bordering narrow, irregularly shaped, low terraces and small fans. The water table is generally at a depth of about 3 feet, but it ranges from 1 foot to 5 feet below the surface. Areas range from 150 to 800 feet wide and are widest in the river valleys. They are sometimes flooded during spring runoff. Slopes are mostly 0 to 2 percent. Depth of the alluvium ranges from 24 to more than 60 inches. The material on the river flood plains in many places is gravelly and sandy below a depth of 24 inches. Heavy growths of brushy plants are common on most of the mapped areas.

Runoff is slow, and the hazard of flooding and erosion is severe. Alluvial land, wet, is used for range, pasture, recreation, and wildlife. Capability unit IVw-2



dryland; Wet Land range site, 15- to 19-inch precipitation zone; windbreak suitability group 3W.

### Amherst Series

The Amherst series consists of shallow, undulating to hilly, well-drained soils on high hills in tilted sedimentary uplands. Slopes range from 4 to 35 percent. These soils are underlain by hard, platy shale and sandstone at a depth of 10 to 20 inches. They formed in place in material weathered from the bedrock. Elevation ranges from 3,600 to 4,300 feet.

The native vegetation is bluebunch wheatgrass, Idaho fescue, western wheatgrass, prairie junegrass, blue grama, fringed sagewort, and big sagebrush. Annual precipitation is 14 to 16 inches, the average annual soil temperature is 45° to 47° F, and the frost-free period is 100 to 110 days.

In a representative profile the surface layer is dark grayish-brown silty clay loam about 2 inches thick. The subsoil is dark-brown, brown, and light olive-brown silty clay loam and clay about 17 inches thick. Hard platy shale is at a depth of 19 inches.

Permeability is moderate, and available water capacity is very low. The effective rooting depth is about 19 inches. Root mats form in the upper several inches of the bedrock. These soils are used for range, recreation, wildlife, watershed, and dryfarmed crops.

Representative profile of Amherst silty clay loam, in an area of Amherst complex, rolling, in grassland, 1,980 feet north and 200 feet west of the SE. corner sec. 14, T. 5 S., R. 28 E.

- A—0 to 2 inches, dark grayish-brown (10YR 4/2) silty clay loam, dark brown (10YR 3/3) moist; moderate, fine, granular structure; hard, firm, sticky and plastic; many very fine roots; 5 percent (volume) flat, hard shale fragments of channer sizes; clear, smooth boundary.
- B1—2 to 5 inches, dark-brown (10YR 4/3) silty clay loam, dark brown (10YR 3/3) moist; moderate, fine, blocky structure; dry, firm, very sticky and very plastic; many very fine roots; few ¼-inch shale fragments; clear, smooth boundary.
- B2t—5 to 9 inches, brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; moderate, medium, prismatic structure parting to strong, fine, blocky; very hard, very firm, very sticky and very plastic; common very fine roots; moderately thick, patchy clay films on peds; 5 percent (volume) flat fragments of channer size; clear, wavy boundary.
- B3—9 to 19 inches, light olive-brown (2.5Y 5/4) light clay, olive brown (2.5Y 4/4) moist; weak, medium, prismatic structure parting to moderate, medium, blocky; hard, firm, sticky and plastic; common very fine roots; 10 to 45 percent (volume) hard shale fragments of channer size; abrupt, wavy boundary.
- R—19 to 23 inches, hard platy shale and about 20 percent clay-filled interstices; moderately effervescent; lime casts on bottom of shale fragments.

Depth to hard bedrock ranges from 10 to 20 inches. Coarse fragments of shale in places cover as much as 15 percent of the soil surface. The volume of coarse fragments ranges from 0 to 15 percent in the upper 10 inches and from 10 to 50 percent in the lower part of the soil. The A horizon is loam or silty clay loam. The B2t horizon ranges from dark brown to grayish brown. It is 35 to 50 percent clay.

**Amherst loam, undulating (Au).**—This soil is on wide, smooth ridges and knolls in tilted sedimentary uplands. Slopes range from 4 to 8 percent. The soil has

a profile similar to the one described as representative of the series, but it is steeper and has a surface layer of loam. Included in mapping are small spots of Castner loam and Rock outcrop.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for range, hay, wildlife, recreation, watershed, and dryfarmed crops. Capability unit IVE-2 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 3M.

**Amherst loam, rolling (AVa).**—This soil is on hills and ridges in tilted sedimentary uplands. Slopes are mostly 8 to 10 percent, but they are steeper in the main drainageways. Slopes are 200 to 350 feet long. The soil has a profile similar to the one described as representative of the series, but it has a surface layer of loam that in places has a few siliceous pebbles from weathered conglomerate rock, and in some areas it has a substratum that is light brown to pinkish gray and that contains fragments of hard, noncalcareous sandstone. Included in mapping are small spots of Rock outcrop and Castner loam.

Runoff is medium, and the hazard of erosion is moderate. This soil is used mostly for range, hay, wildlife, recreation, and watershed. A few areas are included with less steep soils and are used for dryfarmed crops. Capability unit IVE-2 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 3M.

**Amherst complex, rolling (AVb).**—This complex is made up of rolling soils on ridges and hills in tilted sedimentary uplands. It is about 65 percent Amherst silty clay loam and clay loam and 35 percent Castner loam, Rock outcrop, and Reeder loam. Slopes are mostly 10 to 15 percent and range from 150 to 300 feet long. The longest slopes are on the north faces of the anticlines. The Amherst soil in this complex has the profile described as representative of the Amherst series.

Runoff is medium, and the hazard of erosion is moderate. These soils are used for range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 3M.

**Amherst complex, hilly (AVc).**—This complex is made up of hilly soils on a succession of roughly parallel ridges and narrow drainageways in tilted sedimentary uplands. It is about 50 percent Amherst silty clay loam; 35 percent Reeder, Absarokee, Regent, and Eltsac soils; and 15 percent Rock outcrop and Shale outcrop. Slopes are mostly 15 to 25 percent, but they range to 35 percent. Erosion has exposed the various-textured strata of bedrock. Shale outcrop, Rock outcrop, and the Eltsac soil are mostly on the steeply sloping south sides of the ridges. The Reeder, Absarokee, and Regent soils are on the smooth, north-facing slopes of the tilted bedrock. Shale outcrop has slopes of as much as 60 percent.

Runoff is rapid, and the hazard of erosion is severe. These soils are used for range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Thin Hilly range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**Amherst-Maginnis complex, hilly (AVd).**—This complex is made up of hilly and very steep soils on rough, broken hills, ridges, and escarpments in the sedimen-



tary uplands. It is about 40 percent Amherst loam, 35 percent Maginnis channery loam, and 25 percent platy, hard Shale outcrop and Rock outcrop. Slopes range from 15 to 35 percent on the Amherst and Maginnis soils and to as much as 75 percent on the Shale outcrop. Slopes are 75 to 200 feet long. The Amherst soil is on rounded ridgetops and hilltops and the upper sides of valleys. The Maginnis soil is on the lower sides of valleys, on narrow ridges, and along the top edge of rock escarpments.

Runoff is rapid, and the hazard of erosion is severe. These soils are used for range, watershed, recreation, and wildlife. Capability unit VIIe-1 dryland; Thin Hilly range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

### Armington Series

The Armington series consists of deep, gently sloping to steep and rolling, well-drained soils on hills and ridges of divides between mountain valleys and canyons. Slopes are mostly 4 to 15 percent, but they range to 35 percent. These soils formed in alluvium or in material weathered in place from shale. Elevation ranges from 4,000 to 6,000 feet.

The native vegetation is green needlegrass, western wheatgrass, chokecherry, cinquefoil, sedges, Idaho fescue, thornapple, and prairie junegrass. Annual precipitation is 15 to 18 inches, the average annual soil temperature is 41° to 46° F, and the frost-free period is 90 to 115 days.

In a representative profile the surface layer is reddish-brown silty clay loam about 4 inches thick. The subsoil, about 29 inches thick, is reddish-brown and weak-red clay. The substratum is red clay that extends to a depth of 60 inches or more.

Permeability is very slow, and available water capacity is moderate or high. The effective rooting depth is 60 inches or more. These soils are used for range, wildlife, recreation, and watershed.

Representative profile of Armington silty clay loam, in grassland, 1,980 feet north and 660 feet east of the SW. corner sec. 34, T. 4 S., R. 29 E.

- A1—0 to 4 inches, reddish-brown (5YR 4/3) silty clay loam, dark reddish brown (5YR 3/3) moist; thick, platy structure parting to strong, very fine, subangular blocky; hard, firm, very sticky and very plastic; common fine and very fine and few medium roots; 10 percent limestone, chert, and shale fragments; gradual boundary.
- B1—4 to 11 inches, reddish-brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) moist; moderate, fine, prismatic structure parting to strong, fine and medium, blocky; hard, firm, very sticky and very plastic; few very fine, fine, and medium roots; common fine and medium tubular pores; strong effervescence; clear boundary.
- B21—11 to 16 inches, weak-red (10YR 5/4) clay, red (10YR 4/6) moist; moderate, fine, prismatic structure parting to strong, fine and medium, blocky; very hard, firm, very sticky and very plastic; few very fine, fine, and medium roots; common fine and medium tubular pores; 10 percent (volume) limestone and chert fragments; strong effervescence; gradual boundary.
- B22—16 to 33 inches, weak-red (10YR 5/4) clay, red (10YR 4/6) moist; strong, medium and coarse, prismatic structure parting to strong, coarse, blocky; few

slickensides; extremely hard, very firm, very sticky and very plastic; few roots, mainly between pedis; few fine and medium tubular pores; strong effervescence; few lime masses; gradual boundary.

C—33 to 60 inches, red (10YR 5/6) clay, red (10YR 4/6) moist; massive; extremely hard, very firm, very sticky and very plastic; few roots; few fine pores; strong effervescence.

Depth to the calcareous layer ranges from 4 to 10 inches. The A1 horizon ranges from dark-brown to reddish-brown silty clay loam, silty clay, or clay. The B2 horizon ranges from weak red to reddish brown.

**Armington silty clay loam (AWa).**—This soil is on the smooth upper parts and north and east sides of ridges and hills and at the heads of drainageways. Areas range from 20 to 120 acres in size. Slopes are mostly 12 to 15 percent but range to 8 percent on ridgetops. The soil has the profile described as representative of the series. Included in mapping are small areas of Darret soils.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for range, hay, pasture, recreation, watershed, and wildlife. Capability unit IVE-2 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 2M.

**Armington complex, rolling (AWb).**—This complex is made up of soils that have a surface layer of silty clay loam and clay. It is in bands on foot slopes below shale and sandstone escarpments. The foot slopes are typically dissected by narrow drainageways, 10 to 30 feet deep. Slopes are short. They range from 8 to 15 percent but are mostly 12 to 15 percent. The Armington silty clay loam in this complex has the profile described as representative of the Armington series. The Armington clay has a profile similar to the one described as representative, but the surface layer is clay.

Included with these soils in mapping are small areas of red soils that are similar to Allentine soils. Also included in places are small fans and knolls of shale bedrock.

Runoff is rapid, and the hazard of erosion is moderate. These soils are used for range, wildlife, recreation, watershed, and pasture. Capability unit IVE-2 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 2M.

### Arnegard Series

The Arnegard series consists of deep, gently sloping to steep and hilly, well-drained soils on fans and foot slopes. Slopes range from 2 to 35 percent. These soils formed in alluvium derived from mixed rocks in small stream valleys. Elevation ranges from 3,500 to 4,800 feet.

The native vegetation is mainly Sandberg bluegrass, green needlegrass, snowberry, and horsemint. Annual precipitation is 14 to 17 inches, the average annual soil temperature is 44° to 46° F, and the frost-free period is 110 to 115 days.

In a representative profile the surface layer is very dark grayish-brown and very dark gray loam about 14 inches thick. The subsoil is dark-gray clay loam about 17 inches thick. The substratum is dark grayish-brown, dark-brown, and brown clay loam and loam that extends to a depth of 61 inches or more.



Permeability is moderate, and available water capacity is high. The effective rooting depth is 60 inches or more. These soils are used for range, wildlife, recreation, watershed, and irrigated and dryfarmed crops.

Representative profile of Arnegard loam, 8 to 15 percent slopes, in grassland, 660 feet south and 180 feet east of the center of sec. 12, T. 7 S., R. 37 E.

- A—0 to 5 inches, very dark grayish-brown (10YR 3/2) loam, black (10YR 2/1) moist; weak, very fine, crumb structure; soft, very friable, nonsticky and slightly plastic; many fine roots; gradual boundary.
- AB—5 to 14 inches, very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak, medium, prismatic structure parting to weak, fine, subangular blocky; soft, very friable, slightly sticky and slightly plastic; common fine roots; gradual, wavy boundary.
- B—14 to 31 inches, dark-gray (10YR 4/1) clay loam, very dark gray (10YR 2/1) moist; weak, coarse, prismatic structure parting to weak, coarse, blocky; hard, friable, slightly sticky and plastic; common fine roots; gradual boundary.
- C1—31 to 43 inches, dark grayish-brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; weak, coarse, prismatic structure parting to weak, coarse, blocky; hard, friable, slightly sticky and plastic; a few fine roots; clear, wavy boundary.
- C2—43 to 56 inches, dark-brown (10YR 4/3) clay loam, very dark brown (10YR 2/2) moist; massive; hard, friable, sticky and plastic; few fine roots; clear, wavy boundary.
- C3—56 to 61 inches, brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; massive; hard, firm, sticky and plastic; slightly effervescent.

The dark-colored surface layer ranges from 20 to 50 inches in thickness. The A horizon is brown, dark-brown, dark grayish brown, and very dark grayish-brown loam and silt loam. The B horizon is 20 to 30 percent clay. The C horizon is dark grayish brown, light brown, brown, and grayish brown.

**Arnegard loam, 8 to 15 percent slopes (Axa).**—This soil is on foot slopes and fans. Slopes are mostly 12 to 15 percent on the foot slopes and 8 percent on the fans. The soil has the profile described as representative of the series.

Runoff is medium, and the hazard of erosion is moderate. This soil often receives runoff from soils above it. It is used for range, wildlife, recreation, watershed, dryfarmed crops, and hay. Capability unit IVE-2 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Arnegard silt loam, 2 to 4 percent slopes (Axb).**—This soil is on fans and terraces. Slopes are mostly 2 percent and range from 150 to 300 feet long. The soil has a profile similar to the one described as representative of the series, but it is less steep, the surface layer is silt loam, and the lower part of the substratum in places contains thin lenses of gravelly red shale and chips of sandstone. Included in mapping are small areas of Farnuf loam.

Runoff is medium, and the hazard of erosion is slight. Most areas receive runoff from soils above them or from drainageways. This soil is used for irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIE-2 dryland, IIE-1 irrigated; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Arnegard silt loam, 4 to 8 percent slopes (Axc).**—This soil is on fans and foot slopes. Slopes are mostly

7 and 8 percent. The soil has a profile similar to the one described as representative of the series, but the surface layer is silt loam and in places the lower part of the substratum is reddish-brown silt loam.

Included with this soil in mapping are spots of Farnuf loam. In a few areas these included soils make up 30 percent of the area of this mapping unit.

Runoff is medium, and the hazard of erosion is moderate. Most areas receive runoff from soils above them or from tributary valleys. This soil is used for dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIIe-2 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

## Arvada Series

The Arvada series consists of deep, nearly level and gently sloping, well-drained, alkali-affected soils on fans, terraces, and valley bottoms. Slopes range from 0 to 4 percent. These soils formed in mixed clay and loam alluvium. Elevation ranges from 2,800 to 3,800 feet. The native vegetation is a sparse stand of salt- and alkali-tolerant forbs, greasewood, alkali sacaton, inland saltgrass, and western wheatgrass.

Annual precipitation is 12 to 14 inches, the average annual soil temperature is 47° to 49° F, and the frost-free period is 115 to 125 days.

In a representative profile the surface layer is grayish-brown and light brownish-gray silt loam about 3 inches thick. The subsoil is grayish-brown clay and silty clay about 15 inches thick. The substratum is grayish-brown and pale-brown silty clay that extends to a depth of 60 inches or more.

Permeability is very slow, and available water capacity is moderate or high. The effective rooting depth is 60 inches or more. These soils are used mostly for range, recreation, and wildlife. A few areas are mixed with other soils and are used for dryfarmed crops.

Representative profile of Arvada silty clay loam, in grassland, 1,980 feet south and 660 feet west of the NE. corner of sec. 14, T. 4 S., R. 30 E.

- A21—0 to 2 inches, grayish-brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; weak, thin, platy structure; soft, very friable, nonsticky and slightly plastic; common vesicular pores; abrupt, smooth boundary.
- A22—2 to 3 inches, light brownish-gray (10YR 6/2) silt loam, dark brown (10YR 4/3) moist; moderate, very thin, platy structure; soft, very friable, nonsticky and slightly plastic; common vesicular pores; many clean sand grains coating the tops of the plates; abrupt, smooth boundary.
- B2t—3 to 13 inches, grayish-brown (10YR 5/2) clay, very dark grayish brown (10YR 3/2) moist; strong, medium, prismatic structure parting to strong, medium, blocky; extremely hard, very firm, very sticky and very plastic; moderately thick, patchy clay films on peds; few fine roots; clear, wavy boundary.
- B3cacs—13 to 18 inches, grayish-brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; moderate, medium, blocky structure; strongly effervescent; few fine lime threads and gypsum crystals; gradual, wavy boundary.
- C1—18 to 30 inches, grayish-brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; massive; very hard, very firm, very sticky and very plastic; strongly effervescent; gradual, wavy boundary.

C2—30 to 60 inches, pale-brown (10YR 6/3) silty clay, dark yellowish brown (10YR 3/4) moist; massive; very hard, firm, sticky and plastic; strongly effervescent.

Depth to calcareous material ranges from 8 to 18 inches. The A2 horizon ranges from grayish brown to light gray. The B2t horizon is clay, clay loam, and silty clay. The C2 horizon in places is stratified with loam, silt loam, and sandy loam below a depth of 30 inches.

**Arvada silty clay loam (Ayd).**—This soil is on fans and terraces. Slopes are mostly 0 to 2 percent, but they range to 4 percent along shallow drainageways and at the edges of terraces. The soil has the profile described as representative of the series.

Included with this soil in mapping are areas of Bone clay in microdepressions. These included soils make up about 10 percent of the area of this mapping unit.

Runoff is slow, and the hazard of erosion is slight. This soil is used for range, wildlife, and recreation. Capability unit VIs-1 dryland; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 3S.

**Arvada-Bone clays (Ayè).**—This complex is made up of nearly level and gently sloping soils on small terraces and fans. It is 60 to 80 percent Arvada clay, 15 to 30 percent Bone clay, and 5 to 10 percent Hydro silty clay loam. The nearly barren Bone soil is in distinct microdepressions, 3 to 8 inches deep. Slopes are 1 percent or less on the terraces and 3 to 4 percent on the fans and the terrace edges.

Runoff is slow, and the hazard of erosion is slight. These soils are used for range, wildlife, and recreation. Capability unit VIs-1 dryland; Pan Spots range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

### Ascalon Series

The Ascalon series consists of deep, sloping, well-drained soils on fans and foot slopes and in shallow drainageways in the sandstone uplands. Slopes range from 4 to 8 percent. These soils formed in alluvium. Elevation ranges from 3,000 to 3,800 feet.

The native vegetation is mainly blue grama, needle-and-thread, prairie sandreed, green sage, and eriogonum. Annual precipitation is 13 to 14 inches, the average annual soil temperature is 47° F, and the frost-free period is 110 to 115 days.

In a representative profile the surface layer is dark grayish-brown sandy loam about 7 inches thick. The subsoil is dark grayish-brown, grayish-brown, and brown sandy clay loam about 20 inches thick. The substratum is light yellowish-brown and pale-yellow sandy loam that extends to a depth of 65 inches or more.

Permeability is moderate, and available water capacity is moderate. The effective rooting depth is 60 inches or more. These soils are used for range, wildlife, recreation, watershed, dryfarmed crops, and pasture.

Representative profile of Ascalon sandy loam, 4 to 8 percent slopes, in a cultivated area, 1,650 feet north and 100 feet west of the SE. corner of sec. 21, T. 7 S., R. 35 E.

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 2/2) moist;

weak, subangular blocky structure parting to single grained; soft, friable, nonsticky and slightly plastic; common fine roots; abrupt, smooth boundary.

B21t—7 to 11 inches, dark grayish-brown (10YR 4/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; moderate, coarse, prismatic structure; hard, friable, slightly sticky and plastic; common very fine roots; common very fine pores; clay coating on sand grains; gradual, wavy boundary.

B22t—11 to 19 inches, grayish-brown (10YR 5/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; moderate, medium, prismatic structure; hard, friable, slightly sticky and plastic; common very fine roots; common very fine pores; thin, patchy clay films in pores; gradual, wavy boundary.

B3—19 to 27 inches, brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; weak, medium, prismatic structure; hard, friable, nonsticky and slightly plastic; few fine roots and very fine pores; clear, wavy boundary.

C1—27 to 32 inches, light yellowish-brown (2.5Y 6/4) sandy loam, olive brown (2.5Y 4/4) moist; massive; friable, nonsticky and slightly plastic; few very fine pores; strongly effervescent; few very fine lime mottles; gradual, wavy boundary.

C2ca—32 to 53 inches, light yellowish-brown (2.5Y 6/4) sandy loam, light olive brown (2.5Y 5/4) moist; massive; hard, friable, nonsticky and slightly plastic; strongly effervescent; common fine lime mottles gradual, wavy boundary.

C3—53 to 65 inches, pale-yellow (2.5Y 7/4) sandy loam, light yellowish brown (2.5Y 6/4) moist; massive; slightly hard, friable, nonsticky and slightly plastic; strongly effervescent; few fine lime mottles; few sandstone fragments.

Depth to calcareous material ranges from 18 to 40 inches. The Ap horizon ranges from 7 to 10 inches in thickness, and the B2t horizon, from 6 to 20 inches. On north-facing slopes, the A horizon ranges from 8 to 14 inches in thickness. The B2t horizon ranges from 20 to 30 percent clay. The soil is 0 to 10 percent coarse fragments of sandstone throughout the profile.

**Ascalon sandy loam, 4 to 8 percent slopes (Az).**—This soil is on smooth foot slopes and at the heads of drainageways in narrow, shallow valleys of the sedimentary uplands. Areas range from 10 to 20 acres in size. Slopes are steepest on the foot slopes and the heads of drainageways.

Runoff is slow, and the hazard of erosion is moderate. This soil is used for dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIIe-2 dryland; Sandy range site, 10- to 14-inch precipitation zone; windbreak suitability group 2M.

### Babb Series

The Babb series consists of deep, rolling to very steep, well-drained soils on hills and valley sides. Slopes range from 8 to 70 percent. These soils formed in gravelly and channery loam material derived from the underlying bedrock or in colluvium derived from limestone, shale, and siltstone bedrock. Elevation ranges from 4,500 to 7,000 feet.

The native vegetation is mainly a dense stand of Douglas-fir, spruce, and juniper and an understory of snowberry, ninebark, oregongrape, mountain maple, and thimbleberry. Annual precipitation is 18 to 24 inches, the average annual soil temperature is 42° to 44° F, and the frost-free period is 60 to 70 days.

In a representative profile the surface layer is a thin mat of decomposed evergreen needles and twigs over



a thin layer of dark grayish-brown silt loam. The subsoil is grayish-brown, light brownish-gray, and brown loam, clay loam, and channery loam about 24 inches thick. The substratum is white very channery loam that extends to a depth of 60 inches or more.

Permeability is moderate, and available water capacity is low or moderate. The effective rooting depth is 60 inches or more. These soils are used for woodland, watershed, recreation, range, and wildlife.

Representative profile of Babb silt loam, hilly, in woodland, 660 feet south and 400 feet east of the NW. corner sec. 34, T. 8 S., R. 31 E.

- O1—1 inch to 0, loose mat of partly decomposed pine needles and twigs; abrupt, smooth boundary.
- A—0 to 3 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak, medium, platy structure; slightly hard, sticky and plastic; common fine and medium roots; 5 percent (volume) 1- to 3-inch fragments of chanter size; clear, smooth boundary.
- B1—3 to 10 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak, medium, blocky structure; hard, friable, sticky and plastic; common fine and medium roots; 10 percent (volume) fragments of chanter size; clear, wavy boundary.
- B2—10 to 20 inches, brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; moderate, fine, blocky structure; hard, friable, sticky and plastic; common fine and micro roots; 10 percent (volume) fragments of chanter size; clear, wavy boundary.
- B3—20 to 27 inches, light brownish-gray (10YR 6/2) channery loam, dark brown (10YR 4/3) moist; weak, medium, blocky structure; hard, friable, sticky and plastic; common very fine and micro roots; 20 percent (volume) fragments of chanter size; strongly effervescent; thin lime coating on fragments; clear, wavy boundary.
- Cca—27 to 60 inches, white (10YR 8/2) very channery loam, pale brown (10YR 6/3) moist; massive; hard, friable, sticky and plastic; few very fine and micro roots; 60 percent (volume) fragments of chanter size; violently effervescent; flour lime throughout the mass.

Depth to bedrock ranges from 40 to more than 60 inches. Depth to lime is 16 to 24 inches. The soil ranges from 5 to 15 percent (volume) limestone and shale fragments of gravel and chanter size to a depth of 20 inches, and from 30 to 60 percent between depths of 20 and 60 inches. The A horizon is grayish brown and brown. The B and C horizons are loam and clay loam. The B2 horizon ranges from 10 to 16 inches in thickness. The Cca horizon is light gray and very pale brown.

**Babb silt loam, rolling (BA).**—This rolling soil is on the upper parts of hillsides and ridges in the sedimentary highlands. Slopes are mostly 12 to 15 percent and range from 300 to 800 feet long. The soil has a profile similar to the one described as representative of the series, but the substratum is less than 30 percent coarse fragments, the soil contains less segregated lime, and red shale bedrock is at a depth of 40 to 60 inches. Included in mapping are some areas of Tarrete silty clay loam.

Runoff is rapid, and the hazard of erosion is moderate. This soil is used for timber production, range, pasture, recreation, watershed, and game range. The principal tree species on this soil are Douglas-fir, Engelmann spruce, and subalpine fir. A few quaking aspen grow along the shallow drainageways. The average site index for Douglas-fir is 60.

Timber harvest on this soil faces no major limitations or hazards. Access is from the ridgetops. Most areas benefit from cuttings that open the stands by removing merchantable trees. Slash burning is recommended only where timber harvest has left large concentrations. Minor infestations of bark beetles occur in the Big Horn Mountains. Capability unit IVE-2 dryland; not placed in a range site or windbreak suitability group.

**Babb silt loam, hilly (BB).**—This hilly soil is on the sides of mountain valleys, generally above thick limestone ledges that form the valley rim. Slopes are mostly 25 to 35 percent, but they range to 15 percent. The soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of soils in which depth to red shale is 40 to 60 inches and some areas of Adel and Mayflower soils.

Runoff is rapid, and the hazard of erosion is severe. This soil is used for woodland, range, watershed, recreation, and game range. The principal tree species on this soil are Douglas-fir, Engelmann spruce, and subalpine fir. A few quaking aspen and mountain maple grow on the valley bottoms and lower hillsides. The average site index for Douglas-fir is 60.

Timber harvest on this soil faces no major limitations or hazards, but on the canyon sides erosion is severe on logging and access roads. Most areas benefit from cuttings that open the stands by removing the merchantable trees. Minor infestations of bark beetles occur in the Big Horn Mountains. Capability unit VIe-1 dryland; not placed in a range site or windbreak suitability.

## Beauvais Series

The Beauvais series consists of deep, gently undulating to rolling, well-drained soils on high terraces and hills. Slopes range from 2 to 15 percent. These soils formed in a loess mantle of silty clay loam or silt loam derived from mixed rocks. Elevation ranges from 3,100 to 3,900 feet.

The native vegetation is prairie junegrass, broom snakeweed, western wheatgrass, big sagebrush, and Sandberg bluegrass. Annual precipitation is 15 to 17 inches, the average annual soil temperature is 48° to 50° F, and the frost-free period is 110 to 120 days.

In a representative profile the surface layer is grayish-brown silty clay loam about 5 inches thick. The subsoil is brown silty clay about 4 inches thick. The upper part of the substratum is light-gray silty clay loam, and the lower part is light brownish-gray silty clay loam that extends to a depth of 60 inches or more.

Permeability is moderately slow, and available water capacity is high above a depth of 60 inches. The effective rooting depth is 60 inches or more. These soils are used for dryfarmed and irrigated crops, watershed, wildlife, recreation, and range.

Representative profile of Beauvais silty clay loam, gently undulating, in grassland, 300 feet east and 1,320 feet south of the NW. corner sec. 2, T. 3 S., R. 34 E.

- Ap—0 to 5 inches, grayish-brown (10YR 5/2) light silty clay loam, very dark grayish brown (10YR 3/2) moist; weak, coarse, granular structure; hard,

- friable, sticky and plastic; abrupt, smooth boundary.
- B2t—5 to 9 inches, brown (10YR 5/3) light silty clay, dark brown (10YR 3/3) moist; moderate, medium, prismatic structure parting to moderate, medium, blocky; hard, firm, sticky and plastic; many very fine and few fine tubular pores; distinct, continuous, dark grayish-brown (10YR 4/2), glossy coatings on peds; patchy clay films on peds, in pores, and bridging sand grains; clear wavy boundary.
- C1ca—9 to 16 inches, light-gray (2.5Y 7/2) light silty clay loam, light olive brown (2.5Y 5/4) moist; weak, coarse, prismatic structure parting to weak, coarse and medium, blocky; hard, friable, sticky and plastic; many very fine tubular pores; strongly effervescent; few indistinct, fine lime masses; gradual, wavy boundary.
- C2ca—16 to 30 inches, light brownish-gray (2.5Y 6/2) light silty clay loam, light olive brown (2.5Y 5/4) moist; weak, coarse, blocky structure; hard, friable, sticky and plastic; many very fine tubular pores; strongly effervescent; common coarse lime masses; gradual, wavy boundary.
- C3—30 to 60 inches, light brownish-gray (2.5Y 6/2) heavy silty clay loam, grayish brown (2.5Y 5/2) moist; massive; hard, firm, sticky and plastic; strongly effervescent.

The noncalcareous Ap and B2t horizons range from 6 to 10 inches in combined thickness. In places the soil has 1/16- to 1/2-inch pebbles on the surface and throughout. The Ap horizon ranges from grayish brown to pale brown. The B2t horizon ranges from 35 to 50 percent clay and from brown to dark grayish brown. The Cca and C3 horizons range from light brownish-gray to light yellowish-brown silt loam or silty clay loam.

**Beauvais silty clay loam, gently undulating (Bc).—**This gently undulating soil is on high benches and terraces. Areas range from 40 to 250 acres in size. Slopes are 2 to 4 percent, and they range from 100 to 250 feet long. Drainageways are widely spaced and shallow. The soil has the profile described as representative of the series. Locally, the underlying gravel in places is only semirounded and is mainly sandstone. Included in mapping are areas of Sofia and Richfield soils.

Runoff is medium, and the hazard of erosion is slight. This soil is used for irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIe-2 dryland, IIe-1 irrigated; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Beauvais silty clay loam, undulating (Bd).—**This undulating soil is on benches and high terraces. Areas range from 40 to 150 acres in size. Slopes are mostly 4 to 6 percent, but in places at the junctions of the deep drainageways, they are 7 and 8 percent. Slopes range from 75 to 175 feet long. The soil has a profile similar to the one described as representative of the series, but some fragments of pebble size from weathered conglomerate are on the surface. Included in mapping are small areas of Sofia soils.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for irrigated and dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIIe-2 dryland, IIIe-1 irrigated; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Beauvais silty clay loam, rolling (Be).—**This rolling soil is on narrow foot slopes, knolls, hills, and high stream terraces. Slopes range from 8 to 10 percent on the foot slopes and are as much as 15 percent else-

where. The soil has a profile similar to the one described as representative of the series, but it is steeper and there are a few coarse fragments of gravel size scattered on the surface.

Runoff is rapid, and the hazard of erosion is moderate. This soil is used for wildlife, recreation, watershed, range, hay and dryfarmed and irrigated crops. Capability unit IVe-2 dryland, IVe-2 irrigated; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Beauvais-Gilt Edge silty clay loams, gently undulating (Bf).—**This complex is made up of gently undulating soils on terraces. It is about 75 percent Beauvais silty clay loam and 25 percent Gilt Edge silty clay loam. Slopes are 2 to 4 percent. Drainageways are not well established and surface water collects on the flatter slopes and in swales. Short, uneven slopes predominate, and the Gilt Edge soil has the least gradient. The Gilt Edge soil in this complex has a profile similar to the one described as representative of the Gilt Edge series, but it has a horizon that contains gypsum crystals below a depth of 30 inches. Included in mapping are small spots of Colby soils.

Runoff is slow, and the hazard of erosion is slight. These soils are used for irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIe-2 dryland, IIe-1 irrigated; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 2S.

## Belfield Series

The Belfield series consists of deep, nearly level and gently undulating, and undulating, well-drained soils on fans, terraces, foot slopes, and loess-mantled ridges and hills. Slopes range from 0 to 8 percent. These soils formed in moderately alkaline alluvium and eolian deposits. Elevation ranges from 3,400 to 4,500 feet.

The native vegetation is mainly western wheatgrass, silver sage, green needlegrass, and blue grama. Annual precipitation is 14 to 17 inches, the average annual soil temperature is 45° to 47° F, and the frost-free period is 105 to 115 days.

In a representative profile the surface layer is light brownish-gray silt loam about 3 inches thick. The next layer is light brownish-gray silt loam about 2 inches thick. The subsoil, about 22 inches thick, is grayish-brown, brown, and light yellowish-brown silty clay loam and silty clay. The substratum is light yellowish-brown and pale-yellow silty clay loam that extends to a depth of 60 inches or more.

Permeability is moderately slow in the subsoil, and available water capacity is high in the upper 60 inches. The effective rooting depth is 60 inches or more. These soils are used for range, wildlife, recreation, watershed, and irrigated and dryfarmed crops.

Representative profile of Belfield silt loam, gently undulating, in grassland, 300 feet south and 15 feet west of the NE. corner sec. 25, T. 1 N., R. 38 E.

- A2—0 to 3 inches, light brownish-gray (10YR 5/1) silt loam, very dark grayish brown (10YR 3/2) moist; moderate, thin, platy structure; slightly hard, friable, nonsticky and nonplastic; common fine and very fine roots; common clean sand grains; clear boundary.



**A&B—3** to 5 inches, light brownish-gray (10YR 5/1) silt loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, platy structure; hard, friable, slightly sticky and slightly plastic; common very fine roots; common clean sand grains; gradual boundary.

**B&A—5** to 10 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) rubbed, 2/2 coats) moist; weak, fine, prismatic structure parting to moderate, medium, platy; hard, friable, sticky and plastic; common fine and medium pores; thin, continuous and thick, platy clay films on peds; clear boundary.

**B2t—10** to 22 inches, brown (10YR 5/3) rubbed, 5/2 coats) silty clay, olive brown (10YR 4/3) moist; strong, medium, prismatic structure parting to moderate, medium and fine, blocky; very hard, firm, sticky and very plastic; common fine pores; moderately thick, patchy clay films on peds and in some fine pores; gradual boundary.

**B3—22** to 27 inches, light yellowish-brown (2.5Y 6/4) silty clay loam, olive brown (2.5Y 4/4) moist; moderate, medium, prismatic structure parting to moderate, medium, blocky; very hard, firm, sticky and plastic; common fine pores; thin, patchy clay films on peds; moderately effervescent; few fine lime threads; clear, wavy boundary.

**C1ca—27** to 32 inches, light yellowish-brown (2.5Y 6/4) silty clay loam, olive brown (2.5Y 4/4) moist; weak, medium, blocky structure; very hard, friable, sticky and plastic; strongly effervescent; common lime threads and a few lime mottles that have a diffuse boundary; gradual, wavy boundary.

**C2—32** to 60 inches, pale-yellow (2.5Y 7/4) silty clay loam, light olive brown (2.5Y 5/4) moist; massive; hard, friable, sticky and plastic; strongly effervescent.

Depth to calcareous material ranges from 16 to 26 inches. The A2 and A&B horizons range from 4 to 8 inches in combined thickness. The B2t horizon ranges from 35 to 45 percent clay.

**Belfield silt loam, 0 to 1 percent slopes (Bg).**—This soil is on terraces and fans. Areas are irregular in shape and range to as much as 20 acres in size. Slopes are mostly less than 1 percent. The soil has a profile similar to the one described as representative of the series, but it is less sloping. Included in mapping are small spots of Adger clay.

Runoff is slow, and the hazard of erosion is slight. This soil is used for dryfarmed and irrigated crops, hay, wildlife, recreation, and range. Capability unit IIs-2 dryland, IIs-1 irrigated; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Belfield silt loam, gently undulating (Bh).**—This gently undulating soil is on small fans and foot slopes. Slopes are mostly 2 to 4 percent, but they range to 1 percent. Slopes range from 150 to 300 feet long. The soil has the profile described as representative of the series. Included in mapping are narrow bands of Shaak and Savage soils.

Runoff is slow, and the hazard of erosion is slight to moderate. The soils on the foot slopes receive runoff from the soils above. This soil is used for irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIs-2 dryland, IIs-1 irrigated; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Belfield silt loam, undulating (Bk).**—This undulating soil is on foot slopes and at the heads of drainageways. Areas range from 10 to 15 acres in size. The soil has a profile similar to the one described as representative

of the series, but it is steeper, and in small areas the subsurface layer has been eroded away. Included in mapping are small areas of Savage silty clay loam.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for irrigated and dryfarmed crops, hay, watershed, wildlife, recreation, and range. Capability unit IIIe-2 dryland, IIIe-1 irrigated; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Belfield-Adger complex, 0 to 1 percent slopes (Bm).**—This complex is made up of nearly level soils on terraces and benches. It is about 75 percent Belfield silt loam and 25 percent Adger silty clay. Areas range from 10 to 15 acres in size. The Adger soil is in micro-depressions that are 5 to 15 feet wide and 3 to 5 inches deep. The Belfield soil in this complex has a profile similar to the one described as representative of the Belfield series, but in places wind-laid deposits have thickened the surface layer to 4 or 5 inches.

Runoff is slow, and the hazard of erosion is slight. These soils are used for wildlife, recreation, range, hay, and dryfarmed crops. Capability unit IIs-2 dryland; Pan Spots range site, 15- to 19-inch precipitation zone; windbreak suitability group 3S.

**Belfield-Adger complex, gently undulating (Bn).**—This complex is made up of gently undulating soils on fans, terraces, and foot slopes. It is about 80 percent Belfield silt loam and 20 percent Adger silty clay. Slopes range from 1 to 4 percent. The Adger soil is in shallow microdepressions and has slopes of 1 and 2 percent.

Runoff is slow, and the hazard of erosion is slight. These soils are used for wildlife, recreation, range, hay, and dryfarmed crops. Capability unit IIs-2 dryland; Pan Spots range site, 15- to 19-inch precipitation zone; windbreak suitability group 3S.

**Belfield-Adger complex, undulating (Bo).**—This complex is made up of undulating soils on fans, terraces, and foot slopes. It is 50 to 70 percent Belfield silt loam, 20 to 30 percent Adger silty clay, and 5 to 15 percent Nobe clay. The Belfield, Nobe, and Adger soils occupy the areas between the channels. Slopes range from 2 to 15 percent but are mostly 4 to 8 percent. Included in mapping are some areas of Wayden and Savage soils.

Runoff is medium, and the hazard of erosion is moderate. These soils are used for wildlife, recreation, watershed, range, hay, and dryfarmed crops. Capability unit IIIe-2 dryland; Pan Spots range site, 15- to 19-inch precipitation zone; windbreak suitability group 3S.

## Benteen Series

The Benteen series consists of moderately deep, rolling and hilly, well-drained soils on broad ridges and hills in the sedimentary highlands in the highest part of the Big Horn Mountains. Slopes range from 8 to 35 percent. These soils formed in place in crystalline limestone. Elevation ranges from 7,000 to 8,500 feet.

The native vegetation is Idaho fescue, sedges, lupine, wild geranium, rough fescue, mountain brome grass, mountain timothy, and scattered fir trees. Annual precipitation is 20 to 24 inches, the average annual soil

temperature is 40° to 44° F, and the frost-free period is 55 to 65 days.

In a representative profile the surface layer is dark-brown loam about 4 inches thick. The subsoil is brown and pale-brown clay loam and loam about 18 inches thick. The substratum is pale-brown channery loam that is about 25 percent flat fragments of limestone. Limestone is at a depth of about 29 inches.

Permeability is moderate, and available water capacity is low. The effective rooting depth is about 30 inches. These soils are used for grazing, summer game range, watershed, and recreation.

Representative profile of Benteen loam, rolling, in grassland, 1,320 feet west and 300 feet north of the SW. corner sec. 25, T. 9 S., R. 31 E.

- A11—0 to 2 inches, dark-brown (10YR 4/3) loam, very dark brown (10YR 2/3) moist; weak, very thin, platy structure; soft, very friable, slightly sticky and plastic; many very fine roots; clear, smooth boundary.
- A12—2 to 4 inches, dark-brown (10YR 4/3) heavy loam, dark brown (10YR 3/3) moist; weak, coarse, prismatic structure; hard, friable, sticky and plastic; many very fine roots; common very fine pores; clear, wavy boundary.
- B21t—4 to 10 inches, brown (10YR 5/3) light clay loam, dark brown (10YR 3/3) moist; moderate, medium and coarse, prismatic structure; hard, friable, sticky and plastic; common very fine roots; common very fine pores; few thin, patchy clay films on peds; gradual, wavy boundary.
- B22t—10 to 17 inches, brown (10YR 5/3) clay loam, dark brown (10YR 3/5) moist; moderate, medium and coarse, prismatic structure; hard, friable, sticky and plastic; common very fine roots; common very fine pores; few thin, patchy clay films on peds; clear, wavy boundary.
- B3—17 to 22 inches, pale-brown (10YR 6/3) heavy loam, brown (10YR 5/3) moist; weak, medium, blocky structure; hard, friable, sticky and plastic; common very fine roots; common very fine pores; 15 percent (volume) limestone fragments; clear, wavy boundary.
- C—22 to 29 inches, pale-brown (10YR 6/3) channery heavy loam, brown (10YR 5/3) moist; massive; slightly hard, friable, sticky and plastic; 25 percent (volume) limestone fragments; slightly effervescent in spots; clear, irregular boundary.
- R—29 inches, limestone.

Depth to bedrock ranges from 20 to 40 inches. The A1 horizon is less than 10 percent (volume) coarse limestone fragments. The B2t horizon is 5 to 25 percent fragments of gravel, cobble, and channer size, and the C horizon, 20 to 30 percent. The A horizon is brown or grayish brown. The B2t horizon is light yellowish-brown and pale-brown clay loam or silty clay loam.

**Benteen loam, rolling (Bp).**—This rolling soil is on hills and broad ridges in the sedimentary uplands. Areas range from 40 to 150 acres in size. Slopes are 8 to 15 percent. The soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Duncom soils that are marked by Rock outcrop and limestone channers that cover 20 to 35 percent of the soil surface. Also included are discontinuous, low rock ledges on valley sides.

Runoff is rapid, and the hazard of erosion is severe. This soil is used for range, wildlife, watershed, and recreation. Capability unit VIe-1 dryland; Silty range site, 20- to 24-inch precipitation zone; windbreak suitability group 1.

**Benteen loam, hilly (Br).**—This hilly and steep soil is on hills and ridges in the sedimentary highlands. Areas range from 30 to 250 acres in size. Slopes are mostly 20 to 35 percent, and they range from 300 to 1,000 feet long. The soil has a profile similar to the one described as representative of the series, but it is steeper and the lower part of the substratum is 35 to 45 percent coarse fragments of limestone.

Included with this soil in mapping are some areas of Hanson gravelly loam, Duncom channery loam, and rock ledges that are 3 to 5 feet high. The Hanson soil is on valley sides below the rock ledges.

Runoff is rapid, and the hazard of erosion is severe. This soil is used for range, wildlife, watershed, and recreation. Capability unit VIe-1 dryland; Silty range site, 20- to 24-inch precipitation zone; windbreak suitability group 1.

## Bew Series

The Bew series consists of deep, nearly level and gently undulating, well-drained soils on wide river terraces and fans. Slopes range from 0 to 4 percent. These soils formed in alluvium. Elevation ranges from 2,900 to 3,300 feet.

The native vegetation is mainly western wheatgrass, green needlegrass, big sagebrush, and blue grama. Annual precipitation is 12 to 13 inches, the average annual soil temperature is 48° to 49° F, and the frost-free period is 115 to 125 days.

In a representative profile the surface layer is grayish-brown silty clay loam about 7 inches thick. The subsoil is grayish-brown and light olive-brown clay about 9 inches thick. The substratum is light olive-brown and olive-gray clay that extends to a depth of 62 inches or more.

Permeability is slow, and available water capacity is moderate or high to a depth of 60 inches. The effective rooting depth is 60 inches or more. These soils are used for range, wildlife, recreation, and irrigated and dryfarmed crops.

Representative profile of Bew silty clay loam, 0 to 1 percent slopes, in a plowed field, 1,320 feet south and 1,320 feet west of the NE. corner sec. 31, T. 1 N., R. 33 E.

- Ap—0 to 7 inches, grayish-brown (2.5Y 5/2) light silty clay loam, dark grayish brown (2.5Y 4/2) moist; strong, very fine, granular structure; hard, firm, sticky and plastic; few very fine roots; clear, smooth boundary.
- B2t—7 to 11 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate, medium, blocky structure; very hard, firm, very sticky and very plastic; few very fine roots; common very fine pores; thin, patchy clay films on peds; clear, smooth boundary.
- B3—11 to 16 inches, light olive-brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) moist; moderate, medium and fine, blocky structure; very hard, very firm, very sticky and very plastic; few very fine roots; common very fine pores; slightly effervescent; gradual, wavy boundary.
- C1ca—16 to 28 inches, light olive-brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) moist; strong, medium and fine, blocky structure; very hard, very firm, very sticky and very plastic; few very fine roots; common very fine pores; strongly effervescent; com-



mon fine, soft, irregular lime masses; gradual, wavy boundary.

C2—28 to 41 inches, olive-gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; moderate, coarse, blocky structure; very hard, very firm, very sticky and very plastic; common very fine pores; strongly effervescent; few fine, soft lime masses; clear, wavy boundary.

IICcs—41 to 62 inches, olive-gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; massive; very hard, very firm, very sticky and very plastic; few fine pores; strongly effervescent; common fine gypsum crystals.

Depth to lime ranges from 10 to 16 inches. The undisturbed soil has an A1 horizon of silty clay loam or clay loam that ranges from 1 inch to 3 inches in thickness. The B2t horizon is olive, olive gray, grayish brown, and olive brown. It is 48 to 60 percent clay. The C horizon is olive and light yellowish brown.

**Bew silty clay loam, 0 to 1 percent slopes (Bs).**—This nearly level soil is on high terraces, benches, and fans. Slopes range from 100 to 400 feet long. The soil has the profile described as representative of the series. Included in mapping are spots of Shonkin soils in shallow depressions.

Runoff is slow, and the hazard of erosion is slight. This soil is used for irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIIs-3 dryland, IIIs-1 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Bew silty clay loam, gently undulating (Bt).**—This gently undulating soil is on terraces and fans. Slopes are mostly 2 to 4 percent, but they range to 1 percent. The soil has a profile similar to the one described as representative of the series, but it is steeper. Included in mapping are ½- to 1-acre areas on Shonkin soils.

Runoff is slow, and the hazard of erosion is slight to moderate. This soil is used for irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIIs-3 dryland, IIIs-1 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

## Bitton Series

The Bitton series consists of deep, gently sloping and sloping and hilly, excessively drained soils on dissected remnants of fans and terraces. Slopes range from 2 to 35 percent. These soils formed in gravelly loam alluvium. Elevation ranges from 3,300 to 3,800 feet.

The native vegetation is needleandthread, little bluestem, bluebunch wheatgrass, side-oats grama, broom snakeweed, and phlox. Annual precipitation is 14 to 15 inches, the average annual soil temperature is 46° to 47° F, and the frost-free period is 105 to 120 days.

In a representative profile the surface layer is grayish-brown gravelly loam about 11 inches thick. The underlying material is grayish-brown and pale-brown gravelly and very gravelly loam that extends to a depth of 64 inches or more.

Permeability is rapid, and available water capacity is low. The effective rooting depth is 60 inches or more. These soils are used for range, wildlife, recreation, and watershed. They are a source of road fill and gravel.

Representative profile of Bitton gravelly loam, in an area of Bitton soils, hilly, in grassland, on the west side of ridge approximately 2,300 feet south and 1,000 feet east of the NW. corner sec. 34, T. 4 S., R. 36 E.

A11—0 to 4 inches, grayish-brown (10YR 4/2) gravelly loam, dark brown (10YR 3/3) moist; weak, fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; 15 percent (volume) rounded and semirounded sandstone and shale fragments of gravel size; slightly effervescent; abrupt, smooth boundary.

A12—4 to 11 inches, grayish-brown (10YR 5/2) gravelly loam, dark brown (10YR 3/3) moist; weak, medium, blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; 20 percent (volume) sandstone and shale fragments of gravel size; slightly effervescent; gradual, wavy boundary.

C1—11 to 21 inches, grayish-brown (10YR 5/2) gravelly loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; 35 percent (volume) sandstone and shale fragments of gravel size; strongly effervescent; clear, wavy boundary.

C2ca—21 to 46 inches, pale-brown (10YR 6/3) very gravelly loam, brown (10YR 5/3) moist; weak, fine, subangular blocky structure; soft, friable sticky and plastic; common very fine roots; strongly effervescent; 65 percent (volume) sandstone and shale fragments of gravel size; lime coatings on the bottoms of the fragments; gradual, wavy boundary.

C3—46 to 64 inches, pale-brown (10YR 6/3), stratified gravelly loam and gravelly sandy loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable, nonsticky and slightly plastic; few very fine roots; 45 percent (volume) sandstone and shale fragments of gravel size; strongly effervescent.

The soil ranges from 10 to 20 percent (volume) coarse fragments of semirounded sandstone and burned shale in the upper 11 inches, and from 35 to 65 percent in the underlying layers. The A horizon is dark brown and dark grayish brown. The C horizon ranges from light brownish gray to light brown.

**Bitton gravelly loam, 2 to 8 percent slopes (BU).**—This gently sloping and sloping soil is on dissected, gravelly, mantled shale ridges, benches, and terraces. Slopes are mostly 7 to 8 percent on the ridges and 2 to 3 percent on the terraces. The soil has a profile similar to the one described as representative of the series, but it is reddish brown, and its coarse fragments are mostly quartzite and limestone. Included in mapping are some areas of Peritsa soils at the heads of shallow drainageways.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for dryfarmed crops, hay, watershed, wildlife, recreation, and range. Capability unit IVs-2 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 3M.

**Bitton soils, hilly (BV).**—This complex is made up of hilly loam and gravelly loam soils on deeply dissected gravelly and loess-mantled benches and terraces. Slopes are mostly 15 to 25 percent, but they range to 35 percent. In places, erosion has reduced the original terraces to a few isolated ridges and hills. Slopes are 100 to 250 feet long. The Bitton gravelly loam in this complex has the profile described as representative of the series.

Included with these soils in mapping are some areas of Xavier soils on the wider ridges. Also included are areas of Doney and Wayden soils on lower valley sides.

Runoff is rapid, and the hazard of erosion is severe. These soils are used for range, wildlife, recreation, and watershed. They are a source of road gravel. Capability unit VIe-1 dryland; Thin Hilly range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

### Bone Series

The Bone series consists of well-drained, deep, nearly level and gently sloping, sodium-affected soils on broad river terraces, fans, and valley bottoms. Slopes range from 0 to 4 percent. These soils formed in clay alluvium. Elevation ranges from 2,700 to 3,800 feet.

The native vegetation is a sparse stand of salt- and alkali-tolerant forbs, greasewood, alkali sacaton, inland saltgrass, and western wheatgrass. Annual precipitation is 12 to 14 inches, the average annual soil temperature is 47° to 49° F, and the frost-free period is 115 to 125 days.

In a representative profile the surface layer is grayish-brown silty clay about 2 inches thick. The underlying material is grayish-brown, light olive-brown, and pale-olive clay and silty clay that extends to a depth of 62 inches or more.

Permeability is very slow, and available water capacity is moderate or high. The effective rooting depth is 60 inches or more. These soils are used for range, wildlife, recreation, and irrigated pasture and hay.

Representative profile of Bone clay in grassland, 1,320 feet south and 850 feet east of the NW. corner sec. 36, T. 1 N., R. 34 E.

- A1—0 to 2 inches, grayish-brown (2.5Y 5/2) silty clay, olive brown (2.5Y 4/4) moist; moderate, fine, granular structure; hard, firm, very sticky and very plastic; few fine roots; upper ½ inch is a light-gray, massive crust that has many vesicular pores; clear, smooth boundary.
- C1—2 to 7 inches, grayish-brown (2.5Y 5/2) clay, olive brown (2.5Y 4/4) moist; moderate, very fine, blocky structure; very hard, firm, very sticky and very plastic; many very fine roots; common very fine pores; slightly effervescent; clear, smooth boundary.
- C2cs—7 to 16 inches, light olive-brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) moist; strong, fine and medium, granular structure; slightly hard, friable, very sticky and very plastic; few very fine roots; strongly effervescent; many fine crystals of gypsum and other salts; gradual, wavy boundary.
- C3cs—16 to 37 inches, light olive-brown (2.5Y 5/4) heavy silty clay, olive brown (2.5Y 4/4) moist; massive; very hard, firm, very sticky and very plastic; few very fine pores; strongly effervescent; common fine crystals of gypsum and other salts; gradual, wavy boundary.
- C4cs—37 to 62 inches, pale-olive (5Y 6/3) clay, olive (5Y 4/3) moist; massive; very hard, very firm, very sticky and very plastic; strongly effervescent; many fine crystals of gypsum and other salts.

Depth to calcareous material ranges from 1 inch to 6 inches. The strongly saline layer ranges from 6 to 10 inches in thickness. The A horizon is light brownish gray, grayish brown, and light olive brown. The C horizon is 45 to 60 percent clay. The soil is grayish brown, light olive brown, olive brown, pale olive, and light yellowish brown. It ranges from 2 to 3 percent concentrations of soluble salt throughout the C horizon.

**Bone clay (Bw).**—This nearly level and gently sloping soil is on narrow terraces and fans along stream

bottoms in the sedimentary uplands. Slopes are mostly 2 percent, but they range to 3 and 4 percent on fans and along drainageways on the terraces. The soil has the profile described as representative of the series.

Included with this soil in mapping are some spots of Talag clay. Also included are soils that have a granular saline layer at a depth of less than 20 inches and a water table at a depth of 3 feet or less.

Runoff is slow, and the hazard of erosion is slight. This soil is used for range, wildlife, and recreation. Capability unit VIIs-1 dryland; Dense Clay range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

### Castner Series

The Castner series consists of shallow, undulating to hilly and steep, well-drained soils on hills and ridges in the sandstone uplands. Slopes are mostly 4 to 35 percent, but they range to 2 percent. These soils formed in place from calcareous sandstone. Elevation ranges from 3,700 to 5,000 feet.

The native vegetation is mainly bluebunch wheatgrass, dryland sedges, Sandberg bluegrass, and western wheatgrass. Annual precipitation is 15 to 18 inches, the average annual soil temperature is 44° to 45° F, and the frost-free period is 90 to 110 days.

In a representative profile the surface layer is dark grayish-brown sandy loam about 3 inches thick. The subsoil is dark-brown sandy loam about 7 inches thick. The substratum is brown sandy loam. Hard sandy shale is at a depth of about 12 inches.

Permeability is moderate, and available water capacity is very low. The effective rooting depth is 10 to 20 inches. Most of these soils are used for range, wildlife, recreation, and watershed. A few small areas are included with deeper soils and are used for dry-farmed crops.

Representative profile of Castner sandy loam in an area of Castner-Rock outcrop complex, rolling, in grassland, 1,300 feet south and 700 feet east of the NW. corner sec. 34, T. 4 S., R. 25 E.

- A—0 to 3 inches, dark grayish-brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak, fine, crumb structure; soft, very friable, slightly sticky and slightly plastic; common fine roots; slightly effervescent; clear, smooth boundary.
- B2—3 to 10 inches, dark-brown (10YR 4/3) heavy sandy loam, dark brown (10YR 3/3) moist; weak, medium, prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; strongly effervescent; wavy boundary.
- C—10 to 12 inches, brown (10YR 5/3) heavy sandy loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable, slightly sticky and plastic; few very fine roots; strongly effervescent; abrupt, wavy boundary.
- R—12 to 14 inches, hard sandy shale.

Depth to bedrock ranges from 6 to 20 inches. The soil ranges from 12 to 18 percent clay and from 5 to 35 percent (volume) coarse sandstone fragments. The A and B horizons are dark grayish-brown, dark-brown, and brown sandy loam and loam. The C horizon is brown, light olive brown, pale brown, or light yellowish brown.

Castner soils in the Big Horn County Area contain fewer coarse fragments than typical for the series, but this difference does not alter the use or behavior of the soils.



**Castner-Reeder loams, undulating (CA).**—This complex is made up of undulating soils in the sedimentary uplands. It is about 55 percent Castner loam, 40 percent Reeder loam, and 5 percent Rock outcrop. Slopes are 4 to 8 percent. Neither soil occupies any predictable place on the landscape, but the Castner soil is marked by surface channers. Rock outcrop is nearly level with the surrounding soil surface. The soils in this complex have profiles similar to the ones described as representative of their respective series, but they are less steep.

Runoff is medium, and the hazard of erosion is moderate. These soils are used for range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Shallow range site, 15- to 19-inch precipitation zone; windbreak suitability group 3M.

**Castner-Reeder loams, rolling (CB).**—This complex is made up of rolling soils in the sedimentary uplands. It is about 60 percent Castner loam, 35 percent Reeder loam, and 10 percent Rock outcrop. Slopes are 8 to 15 percent. Neither soil occupies any predictable place on the landscape, but the Castner soil has surface channers. Rock outcrop is nearly level with the surrounding soil surface.

Runoff is medium, and the hazard of erosion is severe. These soils are used for range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Shallow range site, 15- to 19-inch precipitation zone; windbreak suitability group 3M.

**Castner-Rock outcrop complex, rolling (CC).**—This complex is made up of rolling soils in the sedimentary uplands. It is about 50 percent Castner sandy loam, 35 percent Rock outcrop, and 15 percent Absarokee and Amherst soils. Slopes are 8 to 15 percent. The Castner soil is between drainageways. Rock outcrop is scattered in areas of the Castner soil or is a low ledge at the edges of deep drainageways. The Absarokee and Amherst soils are in concave areas on the land surface or at the lower ends of long, north-facing slopes. The Castner soil in this complex has the profile described as representative of the Castner series.

Runoff is medium, and the hazard of erosion is severe. These soils are used for range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Shallow range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**Castner-vebar sandy loams, hilly (CD).**—This complex is made up of hilly and steep soils in the sedimentary uplands. It is about 50 percent Castner sandy loam, 40 percent Vebar sandy loam, and 10 percent Rock outcrop. Slopes are mostly 15 to 25 percent, but they range to as much as 35 percent. The Castner soil is mainly above or around areas of Rock outcrop. The Vebar soil is on the smoother ridgetops, hillsides, and the upper sides of valleys.

Runoff is medium, and the hazard of erosion is severe. These soils are used for range, recreation, watershed, and game range. Capability unit VIe-1 dryland; Sandy range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

## Cherry Series

The Cherry series consists of deep, gently sloping

and sloping, well-drained soils on smooth fans, foot slopes, and terraces. Slopes range from 2 to 8 percent. These soils formed in alluvium washed from mixed shale beds. Elevation ranges from 3,500 to 4,500 feet.

The native vegetation is mainly western wheatgrass, silver sage, green needlegrass, scurf-pea, Hoods phlox, broom snakeweed, and prairie junegrass. Annual precipitation is 14 to 16 inches, the average annual soil temperature is 45° to 47° F, and the frost-free period is 105 to 115 days.

In a representative profile the surface layer is light olive-brown silty clay loam about 2 inches thick. The subsoil is grayish-brown silty clay loam about 6 inches thick. The substratum is light brownish-gray and light yellowish-brown silty clay loam that extends to a depth of 60 inches or more.

Permeability is moderately slow, and available water capacity is high. The effective rooting depth is 60 inches or more. These soils are used for range, wildlife, recreation, watershed, and dryfarmed and irrigated crops.

Representative profile of Cherry silty clay loam, 2 to 8 percent slopes, in grassland, 925 feet west and 350 feet north of the SE. corner sec. 17, T. 5 S., R. 29 E.

- A1—0 to 2 inches, light olive-brown (2.5Y 5/4) light silty clay loam, olive brown (2.5Y 4/4) moist; moderate, thin, platy structure; hard, friable, slightly sticky and plastic; common very fine roots; slightly effervescent; clear, smooth boundary.
- B2—2 to 8 inches, grayish-brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate, medium, prismatic structure parting to moderate, very fine, blocky; very hard, firm, sticky and plastic; common very fine roots; slightly effervescent; gradual, wavy boundary.
- C1ca—8 to 12 inches, light brownish-gray (2.5Y 5/2) heavy silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate, medium, blocky structure; very hard, firm, very sticky and plastic; common very fine roots; common very fine pores; strongly effervescent; few fine, soft lime masses; diffuse, wavy boundary.
- C2ca—12 to 19 inches, light brownish-gray (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate, fine, blocky structure; very hard, firm, very sticky and plastic; common very fine roots; common very fine pores; strongly effervescent; common medium and coarse, white, soft lime masses; diffuse, wavy boundary.
- C3ca—19 to 34 inches, light yellowish-brown (2.5Y 6/4) heavy silty clay loam, light olive brown (2.5Y 5/4) moist; moderate, medium, blocky structure; very hard, firm, very sticky and very plastic; few very fine roots; common very fine pores; strongly effervescent; common medium and fine, soft lime masses; gradual, wavy boundary.
- C4—34 to 60 inches, light yellowish-brown (2.5Y 6/4) heavy silty clay loam, light olive brown (2.5Y 5/4) moist; massive; very hard, firm, very sticky and very plastic; few very fine roots; common very fine pores; few medium and coarse, light yellowish-brown mottles; slightly effervescent.

The A1 and B2 horizons range from 7 to 14 inches in combined thickness. The soil ranges from 25 to 35 percent clay between depths of 10 and 40 inches. The A1 and B2 horizons are light olive brown, light brownish gray, grayish brown, and olive gray. The Cca horizon is light olive gray, pale olive, and light brownish gray.

**Cherry silty clay loam, 2 to 8 percent slopes (Ce).**—This gently sloping and sloping soil is on fans and foot

slopes. Slopes are 2 to 5 percent on the fans and 6 to 8 percent on the foot slopes. They range from 200 to 400 feet long.

Runoff is medium, and the hazard of erosion is moderate. Most areas receive runoff from residual soils that lie above them. This soil is used for range, recreation, wildlife, watershed, dryfarmed crops, hay, and irrigated crops. Capability unit IIIe-2 dryland, IIIe-1 irrigated; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

### Chugter Series

The Chugter series consists of deep, gently sloping to strongly sloping, well-drained soils on fans, foot slopes, and terraces. Slopes range from 2 to 15 percent. These soils formed in loam and gravelly loam alluvium derived from mixed calcareous sedimentary rocks. Elevation ranges from 3,400 to 4,000 feet.

The native vegetation is western wheatgrass, side-oats grama, needleandthread, prairie junegrass, big sagebrush, and cheatgrass. Annual precipitation is 11 to 13 inches, the average annual soil temperature is 47° to 48° F, and the frost-free period is 115 to 125 days.

In a representative profile the surface layer is reddish-brown loam about 6 inches thick. The subsoil is reddish-brown loam about 23 inches thick. The substratum is light reddish-brown loam that extends to a depth of 63 inches or more.

Permeability is moderate, and available water capacity is high. The effective rooting depth is 60 inches or more. These soils are used for range, wildlife, recreation, watershed, and dryfarmed crops.

Representative profile of Chugter loam, 2 to 8 percent slopes, in grassland, 100 feet west and 900 feet north of the SE. corner sec. 10, T. 9 S., R. 40 E.

- Ap—0 to 6 inches, reddish-brown (5YR 5/3) loam, dark reddish brown (5YR 3/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine interstitial pores and few fine tubular pores; abrupt, smooth boundary.
- B2—6 to 10 inches, reddish-brown (5YR 4/3) heavy loam, dark reddish brown (5YR 3/3) moist; moderate, coarse, prismatic structure; hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine and few fine tubular pores; thin clay bridges between sand grains; clear, wavy boundary.
- B3—10 to 16 inches, reddish-brown (5YR 4/3) loam, dark reddish brown (5YR 3/4) moist; weak, coarse, prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine pores; few fine, reddish-brown shale and sandstone fragments; slightly effervescent; gradual, wavy boundary.
- B3ca—16 to 29 inches, reddish-brown (5YR 5/3) loam, reddish brown (5YR 4/4) moist; weak, coarse, blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine pores; few fine shale and sandstone fragments; strongly effervescent; few very fine lime threads; gradual, wavy boundary.
- C1ca—29 to 41 inches, light reddish-brown (5YR 6/3) loam, reddish brown (5YR 5/4) moist; massive; hard, friable, nonsticky and slightly plastic; strongly effervescent; common segregated lime threads; gradual, wavy boundary.
- C2—41 to 63 inches, light reddish-brown (5YR 6/3) loam,

reddish brown (5YR 5/4) moist; massive; slightly hard, friable, nonsticky and slightly plastic; strongly calcareous.

The soil between depths of 10 and 40 inches is loam or clay loam. The Ap horizon ranges from 3 to 6 inches in thickness and is reddish brown, reddish gray, and dark reddish gray. The B2 horizon is reddish brown, red, and yellowish red. The C horizon is light reddish brown, reddish yellow, and red.

**Chugter loam, 2 to 8 percent slopes (Cf).**—This nearly level and gently sloping soil is on foot slopes and fans in red, burned shale uplands. Areas range from 15 to 25 acres in size. The soil has the profile described as representative of the series. Included in mapping are areas of soils that have a surface layer of sandy loam.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for range, watershed, wildlife, recreation, and dryfarmed and irrigated crops. Capability unit IIIe-3 dryland, IIIe-1 irrigated; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Chugter complex, 2 to 15 percent slopes (CG).**—This complex is made up of gently sloping to strongly sloping soils on fans, foot slopes, and terraces in red, burned shale uplands. It is about 60 percent Chugter loam, 25 percent Wibaux loam, and 15 percent Spearman and Hydro soils. The Hydro soil is in valley bottoms. The Wibaux and Spearman soils are on spur ridges and knolls surrounded by the Chugter soil. The Hydro soil in this complex has a profile similar to the one described as representative of the Hydro series, but it is reddish brown.

Runoff is medium, and the hazard of erosion is moderate. These soils are used mainly for range, wildlife, recreation, and watershed. Small areas of the Chugter soil are used for dryfarmed crops and hay where slopes are less than 12 percent. Capability unit IVe-3 dryland; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

### Clapper Series

The Clapper series consists of deep, rolling and hilly and steep, well-drained soils on fans, eroded benches, and terraces. Slopes range from 8 to 35 percent. These soils formed in gravelly loam alluvium. Elevation ranges from 2,900 to 3,600 feet.

The native vegetation is mainly Hoods phlox, blue grama, broom snakeweed, bluebunch wheatgrass, and dryland sedges. Annual precipitation is 12 to 14 inches, the average annual soil temperature is 48° to 50° F, and the frost free period is 115 to 125 days.

In a representative profile the surface layer is dark grayish-brown gravelly loam about 4 inches thick. The underlying layer is gravelly and very gravelly loam and clay loam that extends to a depth of 60 inches or more. It is light brownish gray, light yellowish brown, and light gray in the upper part and pale yellow and light gray in the lower part.

Permeability is moderate, and available water capacity is low or moderate. The effective rooting depth is 60 inches or more. These soils are used mostly for range, wildlife, recreation, and watershed. Some small



areas on the margins of deeper soils are used for dry-farmed crops.

Representative profile of Clapper gravelly loam in an area of Clapper-Harvey complex, rolling, in grassland, 30 feet east and 10 feet south of a grove of pine trees at head of draw; 1,000 feet east and 80 feet south of the NW. corner sec. 11, T. 1 N., R. 31 E.

- A—0 to 4 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots; many very fine pores; 20 percent (volume) fragments of gravel size; clear, wavy boundary.
- C1—4 to 10 inches, light brownish-gray (10YR 6/2) gravelly heavy loam, brown (10YR 5/3) moist; weak, medium, blocky structure; slightly hard, friable, sticky and plastic; many fine roots; 25 percent (volume) fragments of gravel size; strongly effervescent; thin lime casts on bottoms of pebbles; few fine, soft lime masses; gradual, wavy boundary.
- C2—10 to 16 inches, light yellowish-brown (2.5Y 6/4) gravelly heavy loam, light olive brown (2.5Y 5/4) moist; massive; slightly hard, friable, sticky and plastic; many fine and very fine roots; 35 percent (volume) fragments of gravel size; strongly effervescent; thin lime casts on bottoms of pebbles; clear, wavy boundary.
- C3ca—16 to 25 inches, light-gray (2.5Y 7/2) very gravelly heavy loam, light yellowish brown (2.5Y 6/4) moist; massive; hard, friable, very sticky and plastic; common fine and very fine roots; 45 percent (volume) fragments of gravel size; violently effervescent; moderately thick lime casts on bottoms of pebbles; few medium, soft lime masses; clear, wavy boundary.
- C4ca—25 to 31 inches, pale-yellow (5Y 8/3) heavy loam, pale olive (5Y 6/3) moist; hard, friable, sticky and plastic; few very fine roots; many fine pores; 10 percent (volume) fragments of gravel size; violently effervescent; common coarse, soft lime masses; pebbles coated with lime; clear, wavy boundary.
- C5—31 to 44 inches, pale-yellow (5Y 7/3) very gravelly heavy loam, pale olive (5Y 6/3) moist; massive; loose, friable, sticky and plastic; few very fine roots; 60 percent (volume) fragments of gravel size; strongly effervescent; few fine, soft lime masses; thin lime casts on bottoms of pebbles; clear, wavy boundary.
- IIC6—44 to 60 inches, light-gray (5Y 7/2) light clay loam, olive (5Y 5/3) moist; massive; hard, friable, very sticky and very plastic; 5 percent (volume) fragments of gravel size; strongly effervescent.

The soil below a depth of 20 inches is 35 to 65 percent (volume) fragments of gravel and cobble size. Depth to the Cca horizon varies, but it is less than 30 inches. The A horizon is dark grayish-brown, grayish-brown, and brown loam or gravelly loam. The C horizon is 20 to 30 percent clay and 15 to 40 percent calcium carbonate. The C1 and C2 horizons are light brownish gray or light yellowish brown. The Cca horizon is white, light gray, or pale yellow.

**Clapper-Harvey complex, rolling (CH).**—This complex is made up of rolling soils on dissected terraces and terrace escarpments. It is 45 to 75 percent Clapper very gravelly and gravelly loam and 25 to 55 percent Harvey loam and gravelly loam. Slopes are 8 to 15 percent. The soils are intermixed, but the less gravelly Harvey soils are mostly on the wider, less steep ridges and knolls. Areas are mainly less than 3 acres in size. The very gravelly Clapper soil is on broken steep side slopes and in the deeper drainageways. The gravelly Clapper soil in this complex has the profile described

as representative of the Clapper series. The Harvey soils have profiles similar to the ones described as representative of the Harvey series, but they are less steep, have a gravelly surface layer, and contain less carbonate between depths of 10 and 40 inches. Included in mapping are small areas of Terrace escarpments, gravelly.

Runoff is medium, and the hazard of erosion is moderate. These soils are used for range, wildlife, recreation, and watershed. Capability unit VIs-1 dryland; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 3L.

**Clapper-Midway complex, hilly (CK).**—This complex is made up of hilly and steep soils on dissected gravelly terraces underlain by shale bedrock. It is 50 to 60 percent Clapper gravelly loam, 30 to 40 percent Midway clay loam, and 5 to 10 percent Shale outcrop. The numerous dissecting drainageways produce a pattern of narrow, sharply sloping ridges, drainageways, and coulees. The shale bedrock is exposed in drainageways and on the lower sides of the escarpments. Slopes range from 15 to 40 percent, but they are mostly 15 to 25 percent. The Clapper soil is on the terrace remnants and upper sides of escarpments between the drainageways. The Midway soil is on the lower sides of the ridges and hills where the terrace material no longer covers the shale bedrock.

Runoff is rapid, and the hazard of erosion is severe. These soils are used for range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Thin Hilly range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

## Colby Series

The Colby series consists of deep, nearly level to steep and gently undulating to hilly, well-drained soils on terraces, ridgetops, and hills. Slopes range from 1 to 35 percent. These soils formed in alluvium and eolian silt. Elevation ranges from 2,900 to 3,600 feet.

The native vegetation is mainly western wheatgrass, prairie junegrass, and green needlegrass. Annual precipitation is 13 to 15 inches, the average annual soil temperature is 47° to 49° F, and the frost-free period is 110 to 125 days.

In a representative profile the surface layer is grayish-brown silt loam about 5 inches thick. The underlying material is light brownish-gray, pale-yellow, light-gray, and light yellowish-brown silty clay loam and silt loam that extends to a depth of 65 inches or more.

Permeability is moderate, and available water capacity is high. The effective rooting depth is 60 inches or more. These soils are used for dryfarmed crops, hay, pasture, wildlife, recreation, watershed, and range.

Representative profile of Colby silt loam, 4 to 8 percent slopes, in grassland, 1,400 feet north and 1,320 feet west of the SE. corner sec. 23, T. 4 S., R. 29 E.

- A11—0 to 2 inches, grayish-brown (2.5Y 5/2) silt loam, dark grayish brown (2.5Y 4/2) moist; weak, very fine, platy structure; hard, friable, slightly sticky and slightly plastic; many fine roots; slightly effervescent; clear, smooth boundary.

- A12—2 to 5 inches, grayish-brown (2.5Y 5/2) silt loam, dark grayish brown (2.5Y 4/2) moist; weak, coarse, prismatic structure; hard, friable, slightly sticky and slightly plastic; many fine roots; common fine pores; slightly effervescent; clear, wavy boundary.
- C1—5 to 11 inches, light brownish-gray (2.5Y 6/2) light silty clay loam, light olive brown (2.5Y 5/4) moist; weak, prismatic structure parting to weak, medium and coarse, blocky; hard, friable, sticky and plastic; many fine roots; common fine pores; strongly effervescent; few fine, soft lime masses; gradual, wavy boundary.
- C2ca—11 to 15 inches, pale-yellow (2.5Y 7/4) silty clay loam, light olive brown (2.5Y 5/4) moist; weak, coarse, prismatic structure parting to weak, coarse, blocky; very hard, friable, very sticky and plastic; few fine roots; common fine pores; strongly effervescent; few medium and coarse, soft lime masses; gradual, wavy boundary.
- C3ca—15 to 27 inches, pale-yellow (2.5Y 7/4) silty clay loam, light olive brown (2.5Y 5/4) moist; weak, coarse, prismatic structure parting to weak, coarse and medium, blocky; very hard, firm, sticky and very plastic; few fine roots; few fine pores; strongly effervescent; few medium and coarse, soft lime masses; gradual, wavy boundary.
- C4ca—27 to 34 inches, light-gray (2.5Y 7/2) heavy silt loam, light olive brown (2.5Y 5/4) moist; weak, coarse, blocky structure; very hard, friable, sticky and plastic; very few fine roots; common fine pores; strongly effervescent; few coarse, soft lime masses; gradual, wavy boundary.
- C5—34 to 65 inches, light yellowish-brown (2.5Y 6/4) silt loam, light olive brown (2.5Y 5/4) moist; massive; hard, friable, sticky and plastic; strongly effervescent.

Depth to segregated lime ranges from 8 to 10 inches. The soil between depths of 10 and 40 inches is 20 to 35 percent clay.

**Colby silt loam, 4 to 8 percent slopes (Cm).**—This soil is on high terraces. Areas consist of broad, flat-topped ridges separated by deep, smoothly sloping drainageways that are 10 to 15 feet wide. The soil has the profile described as representative of the series.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for irrigated and dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIIe-3 dryland, IIIe-1 irrigated; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Colby silt loam, 8 to 15 percent slopes (Cn).**—This soil is on terraces and benches. Slopes are mostly 12 to 15 percent. The soil has a profile similar to the one described as representative of the series, but it is steeper and is silt loam below a depth of 20 inches.

Runoff is medium, and the hazard of erosion is severe. This soil is used for irrigated and dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IVe-3 dryland, IVe-2 irrigated; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Colby silty clay loam, 1 to 4 percent slopes (Co).**—This soil is on fans and dissected terraces. Slopes are 75 to 250 feet long, and they are mostly 2 percent. The soil has a profile similar to the one described as representative of the series, but the surface layer is silty clay loam. Included in mapping are some areas of Keiser soils.

Runoff is slow, and the hazard of erosion is slight. This soil is used for irrigated and dryfarmed crops,

hay, wildlife, recreation, and range. Capability unit IIIe-2 dryland, IIe-1 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Colby silty clay loam, 4 to 8 percent slopes (Cp).**—This soil is on fans, eroded terraces, and smoothly sloping breaks between terraces. Slopes are mostly 4 to 6 percent, but where drainageways dissect the terrace slopes, they are 7 to 8 percent. The soil has a profile similar to the one described as representative of the series, but the surface layer is silty clay loam.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for irrigated and dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIIe-3 dryland, IIIe-1 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Colby silty clay loam, 8 to 15 percent slopes (Cr).**—This soil is on eroded parts of terraces, fans, and breaks between terraces. In many places it occurs as a band along the edges of major drainageways. Slopes are 75 to 200 feet long. The soil has a profile similar to the one described as representative of the series, but it is steeper and has a surface layer of silty clay loam. Included in mapping are some areas of Clapper and Harvey soils.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for irrigated and dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IVe-3 dryland, IVe-2 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Colby-Beauvais silt loams, undulating (Cs).**—This complex is made up of undulating soils on high gravelly terraces and hills mantled with loess. It is 60 to 75 percent Colby silt loam, 20 to 30 percent Beauvais silt loam, and 5 to 10 percent Terrace escarpments, gravelly. Slopes are 4 to 8 percent. The Colby soil is on the crests of surface undulations and along the edges of the deeper drainageways. The Beauvais soil is on the smooth parts of low ridges and between undulations. Terrace escarpments, gravelly, is at the intersections of deep drainageways and along the terrace edges where erosion has exposed the underlying gravelly terrace material.

Runoff is medium, and the hazard of erosion is moderate. These soils are used for irrigated and dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIIe-3 dryland, IIIe-1 irrigated; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Colby-Beauvais silt loams, rolling (Ct).**—This complex is made up of rolling soils on eroded, loess-mantled gravelly terraces and hills. It is about 70 percent Colby silt loam, 20 percent Beauvais silt loam, and 10 percent Terrace escarpments, gravelly. Slopes are 10 to 15 percent. The Colby soil has slopes of 12 to 15 percent. The Beauvais soil has smoother slopes of 8 to 10 percent and is between drainageways and on the broad crests of surface undulations. Terrace escarpments, gravelly, is at the points of ridges between deep drainageways and along the terrace edges where erosion has exposed the underlying gravelly materials. The Colby and Beauvais soils in this complex have profiles similar to the ones



described as representative of the Colby and Beauvais series, but they are steeper.

Runoff is rapid, and the hazard of erosion is severe. These soils are used for irrigated and dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IVE-3 dryland, IVE-2 irrigated; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Colby-Clapper silt loams, rolling (CU).**—This complex is made up of rolling soils on short breaks between loess-mantled gravelly terraces on shale uplands. It is about 50 percent Colby silt loam and 50 percent Clapper silt loam. Areas are generally long and narrow. The Colby soil is at the tops and bottoms of breaks in the land surface. Slopes are mostly 8 to 10 percent, but they range to 15 percent. The Clapper soil is marked by surface gravel and occupies the midslope positions. The Clapper soil in this complex has a profile similar to the one described as representative of the Clapper series, but the surface layer is silt loam that is only 5 to 15 percent gravel.

Runoff is medium, and the hazard of erosion is severe. Most areas receive runoff from soils that lie above them. These soils are used for watershed, recreation, wildlife, range, hay, pasture, and dryfarmed crops. Capability unit IVE-3 dryland; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 3L.

**Colby-Keiser silty clay loams, 4 to 8 percent slopes (Cv).**—This complex is made up of gently sloping soils on eroded parts of loess-mantled gravelly terraces in shale uplands. It is about 50 percent Colby silty clay loam and 50 percent Keiser silty clay loam. The Colby soil is on narrow ridges and hillsides and along the sides of deep drainageways where slopes are 7 to 8 percent. The Keiser soil has smooth slopes and is on wide ridges, between ridges and hills, and in shallow drainageways. Slopes are 4 and 5 percent. The Colby soil in this complex has a profile similar to the one described as representative of the Colby series, but the surface layer is silty clay loam and gravel is on the surface.

Runoff is medium, and the hazard of erosion is moderate. These soils are used for irrigated and dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIIe-3 dryland, IIIe-1 irrigated; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Colby-Midway complex, 8 to 15 percent slopes (CW).**—This complex is made up of strongly sloping soils on thinly loess-mantled gravelly terraces and benches. It is 50 to 80 percent Colby silty clay loam, 20 to 35 percent Midway silty clay loam, and 5 to 15 percent Harvey loam. Drainageways have cut through the mantle into the underlying shale. In places eolian silt has thickened the original terrace deposits. The Colby soil is on loess-mantled ridges, in tributary drainageways, and on the upper sides of the main valleys. The Midway soil is on the lower sides of ridges and valleys. The Harvey soil is on narrow ridges. The soils in this complex have profiles similar to the ones described as representative of their respective series, but gravel covers 1 to 15 percent of the surface.

Runoff is rapid, and the hazard of erosion is mod-

erate. These soils are used for range, wildlife, recreation, watershed, pasture, and hay. Capability unit IVE-3 dryland; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 3M.

**Colby association, rolling (CX).**—This association is about 65 percent Colby silt loam and 35 percent Terrace escarpments, gravelly. It is on the deeply dissected edges of loess-mantled gravelly terraces. The Colby soil is on ridges and hills between drainageways. Terrace escarpments, gravelly, is on the sides and bottoms of drainageways. Slopes are mostly 8 to 12 percent on the Colby soil and 12 to 15 percent on Terrace escarpments, gravelly. The Colby soil in this complex has a profile similar to the one described as representative of the Colby series, but it is steeper.

Runoff is medium, and the hazard of erosion is moderate. These soils are used for range, wildlife, recreation, watershed, pasture, hay, and dryfarmed crops. Capability unit IVE-3 dryland; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 3M.

**Colby association, hilly (CY).**—This association is about 50 percent Colby silt loam and 50 percent Terrace escarpments, gravelly. It occurs on the eroded edges of high, loess-mantled gravelly terraces. Slopes range from 50 to 200 feet long, and they are 15 to 35 percent. Areas are 1/8 to 1/4 mile wide and as much as 3/4 mile long. The Colby soil is on the upper edges of terraces and on ridges between drainageways. Terrace escarpments, gravelly, is on eroded terrace edges where underlying gravelly terrace material is exposed. Terrace escarpments, gravelly, has slopes of 25 to 35 percent. The Colby soil in this complex has a profile similar to the one described as representative of the Colby series, but on the steeper slopes it is underlain by gravelly loam at a depth of 30 to 40 inches.

Runoff is medium, and the hazard of erosion is severe. These soils are used for range, wildlife, recreation, and watershed. They are a source of road gravel. Capability unit VIe-1 dryland; Thin Hilly range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

## Cushman Series

The Cushman series consists of moderately deep, undulating, well-drained soils on smooth ridges and hilltops in the sedimentary uplands. Slopes range from 4 to 8 percent. These soils formed in place from the underlying mixed shale and sandstone. Elevation ranges from 3,100 to 3,800 feet.

The native vegetation is mainly needleandthread, big sagebrush, western wheatgrass, and fringed sage-wort. Annual precipitation is 12 to 14 inches, the average annual soil temperature is 47° to 49° F, and the frost-free period is 115 to 125 days.

In a representative profile the surface layer is brown loam about 5 inches thick. The subsoil is brown and light brownish-gray clay loam and loam about 11 inches thick. The substratum is light-gray loam. Shale bedrock is at a depth of about 35 inches. The soil is non-calcareous to a depth of about 9 inches and moderately calcareous below this depth. Lime in the substratum is segregated in soft masses and nodules.

Permeability is moderate, and available water capacity is low or moderate. The effective rooting depth is about 36 inches. These soils are used for range, wildlife, recreation, watershed, and dryfarmed crops.

Representative profile of Cushman loam, undulating, in a cultivated area, 400 feet east and 150 feet south of the NW. corner sec. 31, T. 1 S., R. 30 E.

- Ap—0 to 5 inches, brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak, subangular blocky structure; hard, friable, very sticky and plastic; few fine roots; abrupt, smooth boundary.
- B2t—5 to 10 inches, brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate, medium, prismatic structure parting to moderate, medium, blocky; hard, firm, very sticky and plastic; few very fine roots; thin, patchy films on peds; clear, wavy boundary.
- B3—10 to 16 inches, light brownish-gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; moderate, medium, prismatic structure parting to moderate, medium, blocky; hard, friable, sticky and plastic; few very fine roots; thin, patchy clay films on peds; strongly effervescent; few medium lime mottles and mycelia; clear, wavy boundary.
- C1ca—16 to 25 inches, light-gray (2.5Y 7/2) loam, light olive brown (2.5Y 5/4) moist; weak, angular blocky structure; hard, friable, sticky and plastic; few very fine roots; strongly effervescent; common medium and coarse lime mottles; gradual, wavy boundary.
- C2—25 to 35 inches, light-gray (2.5Y 7/2) loam, grayish brown (2.5Y 5/2) moist; massive; hard, friable, sticky and plastic; strongly effervescent; few coarse lime mottles; clear, wavy boundary.
- C3—35 to 40 inches, soft shale.

Depth to shale and sandstone ranges from 20 to 40 inches. Depth to the calcareous part of the soil ranges from 9 to 11 inches. The Ap horizon is grayish brown to brown. The B2t horizon is 27 to 33 percent clay. The C horizon ranges from light yellowish brown to light gray.

**Cushman loam, undulating (Cz).**—This undulating soil is on smooth ridges and hills in the sedimentary uplands. Slopes are 4 to 8 percent. Areas range from 10 to 50 acres in size. Included in mapping are small areas of Heldt, Midway, and Thurlow soils.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for watershed, recreation, wildlife, range, hay, and dryfarmed crops. Capability unit IIIe-3 dryland; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 3M.

## Danvers Series

The Danvers series consists of deep, nearly level and gently sloping and gently undulating to hilly, well-drained soils on fans, benches, and high terraces. Slopes range from 0 to 20 percent. These soils formed in calcareous alluvium. Elevation ranges from 3,500 to 4,500 feet.

The native vegetation is mainly bluebunch wheatgrass, green needlegrass, broom snakeweed, prairie junegrass, and cudweed sagewort. Annual precipitation is 14 to 16 inches, the average annual soil temperature is 42° to 45° F, and the frost-free period is 95 to 110 days.

In a representative profile the surface layer is dark grayish-brown loam about 3 inches thick. The subsoil is dark grayish-brown, grayish-brown, and light yellowish-brown silty clay loam and silty clay about

12 inches thick. The substratum is pale-yellow, light yellowish-brown, and pale-brown silty clay loam and loam that extends to a depth of 65 inches or more.

Permeability is moderate, and available water capacity is high. The effective rooting depth is 60 inches or more. These soils are used mostly for dryfarmed crops, wildlife, recreation, watershed, and range. A few small areas are used for irrigated crops and pasture.

Representative profile of Danvers silty clay loam, gently undulating, in grassland, 600 feet south and 750 feet east of the NW. corner sec. 17, T. 5 S., R. 27 E.

- A—0 to 3 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak, medium, platy structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; clear, smooth boundary.
- B1—3 to 5 inches, dark grayish-brown (10YR 4/2) light silty clay loam, very dark grayish brown (10YR 3/2) moist; weak, medium, prismatic structure parting to moderate, very fine, blocky; hard, friable, sticky and plastic; common very fine roots; clear, smooth boundary.
- B2t—5 to 10 inches, grayish-brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; moderate, medium, prismatic structure parting to moderate, fine and medium, blocky; very hard, firm, very sticky and very plastic; few very fine roots; many fine and medium pores; thin, continuous clay films on peds; clear, wavy boundary.
- B3—10 to 15 inches, light yellowish-brown (2.5Y 6/4) silty clay loam, light olive brown (2.5Y 5/4) moist; moderate, medium, prismatic structure parting to moderate, fine and medium, blocky; hard, friable, sticky and plastic; few fine roots; strongly effervescent; few medium lime mottles; clear, wavy boundary.
- C1ca—15 to 28 inches, pale-yellow (2.5Y 7/4) heavy silty clay loam, light yellowish brown (2.5Y 6/4) moist; weak, coarse, prismatic structure parting to weak, medium, blocky; hard, friable, very sticky and plastic; few very fine roots; violently effervescent; common coarse lime mottles and pockets 4 to 6 inches in diameter; clear, irregular boundary.
- C2—28 to 43 inches, light yellowish-brown (2.5Y 6/4) silty clay loam, light olive brown (2.5Y 5/4) moist; weak, coarse, blocky structure; hard, friable, sticky and plastic; strongly effervescent; few coarse lime mottles; gradual, wavy boundary.
- C3—43 to 65 inches, pale-brown (10YR 6/3) heavy loam, yellowish brown (10YR 5/4) moist; massive; hard, friable, slightly sticky and slightly plastic; strongly effervescent.

Depth to carbonates ranges from 9 to 15 inches. The A horizon is dark grayish brown and brown to light olive brown. The B2t horizon is dark brown and grayish brown to light olive brown. It is 35 to 45 percent clay.

**Danvers silty clay loam, 0 to 1 percent slopes (Da).**—This nearly level soil is on high benches and terraces in shale uplands. It has a profile similar to the one described as representative of the series, but it is less sloping.

Included with this soil in mapping are areas of Shaak, Judith, and Windham soils. The Shaak soil makes up as much as 10 to 30 percent of the area of this mapping unit. It is in level areas or slight depressions where surface drainage is very slow. The Judith and Windham soils are marked by surface gravel.

Runoff is slow, and the hazard of erosion is slight. This soil is used for dryfarmed and irrigated crops,



hay, wildlife, recreation, and range. Capability unit IIc-2 dryland, IIc-1 irrigated; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 2L.

**Danvers silty clay loam, gently undulating (Db).**—This gently undulating soil is on high benches, terraces, and fans in shale uplands. Slopes are 1 to 4 percent. The soil has the profile described as representative of the series.

Included with this soil in mapping are areas of Shaak and Judith soils that make up about 15 percent of the area of this mapping unit. Shaak soils are in level areas, and Judith soils have gravel on the surface.

Runoff is slow, and the hazard of erosion is moderate. This soil is used for dryfarmed and irrigated crops, hay, wildlife, recreation, and range. Capability unit IIe-2 dryland, IIe-1 irrigated; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 2L.

**Danvers silty clay loam, undulating (Dc).**—This undulating soil is on eroded parts of benches, terraces, and fans in shale uplands. Slopes are mostly 6 to 8 percent. The soil has a profile similar to the one described as representative of the series, but it is steeper.

Included with this soil in mapping are areas of Judith and Windham soils that make up about 20 percent of the area of this mapping unit. These included soils are lighter colored than Danvers soils, and they have gravel on the surface.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for dryfarmed and irrigated crops, hay, wildlife, recreation, watershed, and range. Capability unit IIIe-2 dryland, IIIe-1 irrigated; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 2L.

**Danvers cobbly silty clay loam, 1 to 4 percent slopes (Dd).**—This nearly level and gently sloping soil is on broad benches and terraces in shale uplands. Slopes are short, and they are broken by low mounds and narrow ridges. The soil has a profile similar to the one described as representative of the series, but it is 10 to 25 percent limestone fragments of gravel, cobble, and stone size.

Included with this soil in mapping are areas of Judith and Windham soils that make up 10 to 20 percent of the area of this mapping unit.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for recreation, wildlife, range, hay, and dryfarmed crops. Capability unit IIe-2 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 2L.

**Danvers-Judith silty clay loams, gently undulating (De).**—This complex is made up of gently undulating soils on benches and terraces in shale uplands. It is 55 to 70 percent Danvers silty clay loam and 30 to 45 percent Judith silty clay loam. Slopes range from 1 to 4 percent. The Danvers soil is on long slopes of 1 to 2 percent and in concave troughs of surface undulations. The Judith soil is on the convex surfaces of sharper ridges and crests.

Included with these soils in mapping are small areas of Windham soils. They are identified by surface cobbles and gravel along the deeper drainageways and sharp slope breaks in the terrace surface.

Runoff is slow, and the hazard of erosion is moderate. These soils are used for dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIe-2 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 3L.

**Danvers-Judith silty clay loams, undulating (Df).**—This complex is made up of undulating soils on benches and terraces in shale uplands. It is about 60 percent Danvers silty clay loam and 40 percent Judith silty clay loam. Slopes are 4 to 8 percent. The Danvers soil is on smooth areas between the drainageways, and the Judith soil is on low mounds, knolls, and the eroded edges of deep drainageways. The Danvers soil in this complex has a profile similar to the one described as representative of the Danvers series, but in places the upper part of the substratum does not have the nearly white lime layer. Included in mapping are small spots of Windham gravelly loam.

Runoff is medium, and the hazard of erosion is moderate. These soils are used for dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIIe-2 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 3L.

**Danvers-Judith silty clay loams, hilly (Dg).**—This complex is made up of rolling and hilly soils on fans and foot slopes. It is 65 to 85 percent Danvers silty clay loam and 15 to 35 percent Judith silty clay loam. Slopes are mostly 15 to 20 percent, but they range to 8 percent. The Danvers soil is in drainageways, and the Judith soil is on the steeper slopes and the narrow ridges where surface gravel is common. The soils in this complex have profiles similar to the ones described as representative of their respective series, but the surface layer and subsoil are 5 to 20 percent coarse fragments of limestone. Also, a few limestone boulders as much as 2½ feet in diameter lie along deep drainageways.

Runoff is rapid, and the hazard of erosion is severe. These soils are used for dryfarmed crops, hay, pasture, watershed, wildlife, recreation, and range. Capability unit IVE-2 dryland; Thin Hilly range site, 15- to 19-inch precipitation zone; windbreak suitability group 3L.

## Darret Series

The Darret series consists of moderately deep, undulating and rolling, well-drained soils on smooth parts of tilted bedrock uplands. Slopes range from 4 to 15 percent. These soils formed in place from pink, mixed shale and sandstone. Elevation ranges from 4,500 to 6,000 feet.

The native vegetation is mainly green needlegrass, western wheatgrass, cinquefoil, prairie junegrass, Idaho fescue, and wild geranium. Annual precipitation is 16 to 17 inches, the average annual soil temperature is 44° to 46° F, and the frost-free period is 90 to 110 days.

In a representative profile the surface layer is very dark grayish-brown silt loam about 4 inches thick. The subsoil is very dark grayish-brown, dark-brown, and reddish-brown silt loam, silty clay, and silty clay loam about 31 inches thick. Shale and sandstone bedrock is at a depth of about 35 inches.



Permeability is moderate, and available water capacity is moderate. The effective rooting depth is 30 to 40 inches. These soils are used for range, wildlife, recreation, and watershed.

Representative profile of Darret silt loam in an area of Reeder-Darret association, undulating, in grassland, 300 feet west and 200 feet north of the center of sec. 15, T. 7 S., R. 31 E.

- A1—0 to 4 inches, very dark grayish-brown (10YR 3/2) silt loam, very dark brown (10YR 2/2) moist; moderate, very thin, platy structure parting to strong, very fine, granular; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; clear, smooth boundary.
- B1—4 to 7 inches, very dark grayish-brown (10YR 3/3) heavy silt loam, very dark brown (10YR 2/2) moist; moderate, fine, blocky structure; hard, friable, slightly sticky and plastic; many very fine roots; gradual, wavy boundary.
- B21t—7 to 14 inches, dark-brown (7.5YR 4/3) heavy silty clay loam, dark brown (7.5YR 3/3) moist; weak, medium, prismatic structure parting to strong, very fine, blocky; very hard, firm, very sticky and very plastic; many very fine roots; common very fine pores; few very thin clay films on peds; 5 percent (volume) fine chert fragments of pebble size; gradual, wavy boundary.
- B22t—14 to 22 inches, reddish-brown (5YR 5/4) silty clay, reddish brown (5YR 4/4) moist; moderate, medium, prismatic structure parting to strong, medium and fine, blocky; very hard, very firm, very sticky and very plastic; common very fine roots; common very fine pores; thin, patchy clay films on peds; 10 percent (volume) fine chert fragments of pebble size; gradual, wavy boundary.
- B23t—22 to 30 inches, reddish-brown (5YR 5/5) silty clay, reddish brown (5YR 4/4) moist; moderate, medium, prismatic structure parting to strong, medium, blocky; very hard, very firm, very sticky and very plastic; common very fine roots; many very fine pores; very thin, patchy clay films on peds; few chert fragments of pebble size; clear, wavy boundary.
- B3ca—30 to 35 inches, reddish-brown (2.5YR 5/4) silty clay loam, reddish brown (2.5YR 4/4) moist; weak, medium, blocky structure; very hard, firm, very sticky and plastic; few very fine roots; slightly effervescent; few fine and medium, soft lime masses; few limestone fragments of pebble size; gradual wavy boundary.
- C—35 inches, variegated shale and hard sandstone.

Depth to shale and sandstone ranges from 20 to 40 inches. Depth to calcareous material ranges from 18 to 30 inches. The soil is 0 to 15 percent (volume) coarse fragments of limestone, chert, and hard sandstone. The A1 horizon is brown and grayish brown. The B horizon ranges from 36 to 45 percent clay. The B2t horizon is 9 to 24 inches in thickness.

Darret soils in the Big Horn County Area are mapped only with Reeder soils.

## Dast Series

The Dast series consists of moderately deep, rolling to very steep, well-drained soils on ridges and hills of broad drainage divides. Slopes are mostly 8 to 90 percent, but they range to 4 percent. These soils formed in place from calcareous, weakly consolidated sandstone. Elevation ranges from 3,400 to 4,200 feet.

The native vegetation is needleandthread, little blue-stem, prairie sandreed, yucca, hairy goldaster, salsify, and skunkbush sumac. Annual precipitation is 14 to 18 inches, the average annual soil temperature is 45° to 47° F, and the frost-free period is 105 to 115 days.

In a representative profile the surface layer is grayish-brown sandy loam about 3 inches thick. The subsoil is light olive-brown sandy loam about 8 inches thick. The underlying material is light yellowish-brown sandy loam. Weakly consolidated sandstone is at a depth of about 26 inches.

Permeability is moderately rapid, and available water capacity is low. The effective rooting depth is 20 to 40 inches. These soils are used for range, wildlife, recreation, and watershed.

Representative profile of Dast sandy loam, rolling, in grassland, 990 feet west and 425 feet north of the SE. corner sec. 8, T. 4 S., R. 37 E.

- A1—0 to 3 inches, grayish-brown (2.5Y 5/2) light sandy loam, dark grayish brown (2.5Y 4/2) moist; weak, thin, platy structure; soft, very friable, nonsticky and slightly plastic; common very fine roots; clear, smooth boundary.
- B—3 to 11 inches, light olive-brown (2.5Y 5/4) sandy loam, olive brown (2.5Y 4/4) moist; weak, coarse, prismatic structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots; few very fine pores; clear, wavy boundary.
- C1—11 to 19 inches, light yellowish-brown (2.5Y 6/4) sandy loam, light olive brown (2.5Y 5/4) moist; massive; slightly hard, friable, nonsticky and slightly plastic; common very fine roots; slightly effervescent; gradual, wavy boundary.
- C2—19 to 26 inches, light yellowish-brown (2.5Y 6/4) sandy loam, light olive brown (2.5Y 5/4) moist; massive; slightly hard, friable, nonsticky and slightly plastic; few very fine roots; strongly effervescent; gradual, wavy boundary.
- C3—26 to 34 inches, weakly consolidated, platy sandstone.

Depth to sandstone ranges from 20 to 40 inches. The A1 horizon is brown and light olive brown. The C horizon is pale-brown, yellowish-brown, and light olive-brown sandy loam or fine sandy loam that is 10 to 15 percent clay.

**Dast sandy loam, rolling (DHa).**—This rolling soil is on sandstone uplands. Slopes are mostly 8 to 15 percent, but they range to 4 percent. They are smooth and less than 300 feet long. The soil has the profile described as representative of the series.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for wildlife, recreation, watershed, range, hay, and pasture. Capability unit IVE-2 dryland; Sandy range site, 15- to 19-inch precipitation zone; windbreak suitability group 3M.

**Dast sandy loam, hilly (DHB).**—This hilly soil is on sandstone hills and ridges in the sandstone uplands. Slopes are mostly 15 to 25 percent, but they range to 35 percent. Slopes are short and are broken by Rock outcrop (sandstone) on the hillsides and narrow ridgetops. The soil has a profile similar to the one described as representative of the series, but it is steeper. Included in mapping are small areas of Parshall soils and some areas of Rock outcrop (sandstone).

Runoff is rapid, and the hazard of erosion is severe. This soil is used for range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Sandy range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**Dast complex, hilly (DHC).**—This complex is made up of hilly and very steep soils of the sedimentary uplands. It is about 50 percent Dast sandy loam, 15 percent Rock outcrop (sandstone) and Shale outcrop, and 35 percent Doney loam, Wayden silty clay loam, and Ascalon sandy loam. Slopes are mostly 25 to 35 per-



cent, but they range to 50 percent. The Ascalon soil is on foot slopes in wide valleys. The soils in this complex have profiles similar to the ones described as representative of their respective series, but they are steeper. Included in mapping are small spots of Vebar and Judith soils.

Runoff is rapid, and the hazard of erosion is severe. These soils are used for watershed, recreation, watershed, range, and game range. Capability unit VIe-1 dryland; Sandy range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**Dast complex, very steep (DHd).**—This complex is made up of very steep soils of the sedimentary uplands. It is 50 to 60 percent Dast sandy loam, 15 to 25 percent Castner cobbly loam, 5 to 25 percent Armington silty clay loam, and 5 to 10 percent Rock outcrop. Slopes are mostly 35 to 60 percent, but they range to 90 percent. The Dast soil is on the smooth parts of valley sides. The Castner soil is along valley rims and above low rock ledges. The Armington soil is on the pink shale near the valley floor. The soils in this complex have profiles similar to the ones described as representative of their respective series, but they are steeper, and the Castner soil is more than 15 percent coarse fragments.

Runoff is rapid, and the hazard of erosion is severe. These soils are used for range, watershed, wildlife, and recreation. Capability unit VIIe-1 dryland; Thin Hilly range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**Dast-Parshall sandy loams, rolling (Dk).**—This complex is made up of rolling soils in the sedimentary uplands. It is about 60 percent Dast sandy loam and 40 percent Parshall sandy loam. Slopes range from 8 to 15 percent. The Dast soil is on ridges and hills. The Parshall soil is in shallow drainageways and on short foot slopes below sharp ridges.

Runoff is medium, and the hazard of erosion is moderate. These soils are used for wildlife, recreation, watershed, range, hay, pasture, and dryfarmed crops. Capability unit IVe-2 dryland; Sandy range site, 15- to 19-inch precipitation zone; windbreak suitability group 3M.

## Doney Series

The Doney series consists of moderately deep, gently sloping and rolling to very steep, well-drained soils on dissected hills, ridges, and knolls in the sedimentary uplands. Slopes range from 4 to 95 percent. These soils formed in place in material weathered from mixed loam shale, siltstone, and sandstone. Elevation ranges from 3,500 to 5,000 feet.

The native vegetation is mainly bluebunch wheatgrass, Hoods phlox, lupine, western wheatgrass, sagebrush, and green sagewort. Annual precipitation is 14 to 16 inches, the average annual soil temperature is 45° to 47° F, and the frost-free period is 90 to 105 days.

In a representative profile the surface layer is grayish-brown loam about 6 inches thick. The underlying layer is light yellowish-brown and pale-yellow loam that is about 30 percent shale fragments that can

be easily crushed in the hand. Soft sandstone, siltstone, and loamstone are at a depth of about 21 inches.

Permeability is moderate, and available water capacity is low. The effective rooting depth is about 30 inches. These soils are used mostly for range, recreation, wildlife, and watershed. Small areas included with deeper soils in valleys and on broad ridges are used for dryfarmed crops.

Representative profile of Doney loam, rolling, in grassland, 1,300 feet west and 1,000 feet north of the SE. corner sec. 10, T. 6 S., R. 39 E.

A11—0 to 2 inches, grayish-brown (2.5Y 5/2) loam, very dark grayish brown (2.5Y 3/2) moist; weak, thin, platy structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; clear, smooth boundary.

A12—2 to 6 inches, grayish-brown (2.5Y 5/2) heavy loam, dark grayish brown (2.5Y 4/2) moist; weak, medium, prismatic structure; hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; slightly effervescent; clear, wavy boundary.

C2—6 to 13 inches, light yellowish-brown (2.5Y 6/3) heavy loam, olive brown (2.5Y 4/3) moist; massive; hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine pores; strongly effervescent; diffuse, irregular boundary.

C2ca—13 to 21 inches, pale-yellow (2.5Y 7/3) loam, light olive brown (2.5Y 5/4) moist; moderate, medium, platy structure; hard, friable, slightly sticky and slightly plastic; common very fine roots between plates; 35 percent (volume) shale fragments; strongly effervescent; few medium, soft lime masses on the bottoms of the shale fragments; diffuse, irregular boundary.

C3—21 to 26 inches, soft, interbedded, very fine grained sandstone, silt stone, and limestone; few very fine roots following horizontal fractures.

Depth to shale and sandstone ranges from 20 to 40 inches. The C horizon ranges from 18 to 30 percent clay and is light brownish-gray, pale yellow, and pale brown. The lower part of the C horizon ranges from 5 to 35 percent (volume) shale and sandstone fragments.

**Doney loam, rolling (DMA).**—This rolling soil is on hills, ridges, and knolls of broad divides between major valleys in mixed shale and sandstone uplands. Slopes are mostly 8 to 15 percent. The soil has the profile described as representative of the series.

Included with this soil in mapping are spots of Wayden silty clay loam that make up as much as 25 percent of the area of this mapping unit.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for wildlife, recreation, watershed, range, pasture, and dryfarmed crops. Capability unit IVe-2 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 3M.

**Doney silty clay loam, hilly (DMb).**—This hilly and steep soil is on the north-facing slopes of deep valleys in dissected shale uplands. Slopes are mostly 15 to 25 percent, but they range to 35 percent. Areas are 300 to 1,000 feet wide and as much as one-half mile long. They extend from the valley floor to the top of the drainage divide. The soil has a profile similar to the one described as representative of the series, but it is steeper, has a surface layer of silty clay loam that is covered by a 1- to 2-inch mat of pine needles and twigs, and is noncalcareous to a depth of more than 12 inches.

Included with this soil in mapping are 1- to 3-acre



grassy openings. Steeper soils are included around scattered areas of Shale outcrop and low sandstone ledges.

Runoff is rapid, and the hazard of erosion is severe. This soil is used for watershed, recreation, woodland, and game range. The principal tree species are ponderosa pine and Rocky Mountain juniper. The average site index for the ponderosa pine is 70, and the crown density is more than 35 percent.

Timber harvest on this soil in many places causes moderate to severe erosion on logging and access roads, especially on the valley bottoms. Most of the timber is only 60 to 80 years old. The stands are generally open, and only isolated areas are overstocked. Timber harvest is limited to a few overstocked areas. Where areas of this soil are included in range, slash should be piled and roadways seeded after timber harvest. Capability unit VIe-1 dryland; not placed in a range site or windbreak suitability group.

**Doney-Reeder loams, rolling (Dn).**—This complex is made up of rolling soils on broad divides that consist of rounded ridges, hills, and knolls between drainageways in the sedimentary uplands. It is about 40 percent Doney loam, 40 percent Reeder loam, and 20 percent Farnuf loam. Slopes are 8 to 15 percent. The Doney soil has slopes of 12 to 15 percent and is on the narrow ridges and hills. The Reeder soil has slopes of 8 to 10 percent and is on wide ridges and in concave areas at the heads of drainageways and on hilltops.

Included with these soils in mapping are small areas,  $\frac{1}{2}$  acre to 2 acres in size, of Farnuf soils at the heads of short tributary drainageways. Also included are some areas of Regent, Savage, and Wayden soils where deep stream dissection has exposed clay loam and silty clay loam shale.

Runoff is medium, and the hazard of erosion is severe. These soils are used for wildlife, watershed, recreation, range, hay, pasture, and dryfarmed crops. Capability unit IVe-2 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 3M.

**Doney-Ringling complex, rolling (DOa).**—This complex is made up of rolling soils on hills, knolls, and ridges between major valleys in the sedimentary uplands. It is about equal parts of Doney loam and Ringling channery loam and 25 percent Farnuf loam. Slopes are 9 to 15 percent. In places the areas form a band, one-fourth mile wide, on one side of a major valley. The Ringling soil generally caps ridges and hills. The Doney soil generally is below the Ringling soil in areas of highest relief and on hilltops and ridgetops elsewhere. The Farnuf soil is on short foot slopes and small fans at the mouths of short drainageways. The Ringling soil in this complex has the profile described as representative of the Ringling series. Included in mapping are spots of Arnegard soils.

Runoff is medium, and the hazard of erosion is severe. These soils are used for range, recreation, wildlife, and watershed. Capability unit VIe-1 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**Doney-Ringling complex, hilly (DOb).**—This complex is made up of hilly soils in the sedimentary uplands. It is 40 to 60 percent Doney loam, 15 to 30 percent Ring-

ling channery loam, 5 to 15 percent Rock outcrop, and 20 to 30 percent Wayden, Regent, Farnuf, Arnegard, and Reeder soils. Slopes range from 15 to 35 percent, but they are mostly 15 to 25 percent. The native vegetation is ponderosa pine, skunkbush sumac, snowberry, and pinegrass.

The Doney and Ringling soils in this complex are on the steeper hills, ridges, and upper valley sides. Rock outcrop occurs as ledges and escarpments along valley rims and on narrow ridgetops. The Farnuf and Arnegard soils are on foot slopes below rock ledges and in concave areas at the heads of drainageways. The Reeder and Regent soils are in saddles between hills and on smooth ridges. The Wayden soil occurs with the Doney soils. The soils of this complex have profiles similar to the ones described as representative of their respective series, but they are steeper.

Runoff is rapid, and the hazard of erosion is severe. These soils are used for range, watershed, recreation, and game range. Capability unit VIe-1 dryland; Thin Hilly range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**Doney-Ringling complex, very steep (DOc).**—This complex is made up of steep and very steep soils typically along the steep rims and sides of major stream valleys or narrow ridges between deep valleys in deeply dissected sedimentary uplands. It is about 30 percent Doney loam, 30 percent Ringling channery loam, 20 percent Arnegard loam, and 25 percent Shale outcrop. Slopes are mostly more than 45 percent, but they range to 35 percent. Nearly perpendicular ledges of burned and fused red shale are on the valley rims and on the sides of narrow ridges. The native vegetation is ponderosa pine, juniper, skunkbush sumac, and ninebark.

The Ringling soil in this complex is on narrow ridges above Rock outcrop or on the upper sides of valleys. It has slopes of 45 to 60 percent. The Doney soil is on wide ridges and the lower sides of valleys. The Arnegard soil is on foot slopes below Rock outcrop and on the valley bottom. The soils of this complex have profiles similar to the ones described as representative of their respective series, but they are steeper and the Arnegard soil in places is redder.

Runoff is rapid, and the hazard of erosion is severe. These soils are used for range, watershed, recreation, and wildlife. Capability unit VIIe-1 dryland; Thin Breaks range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**Doney-Rock outcrop complex, very steep (DOD).**—This complex is made up of very steep and steep soils in the sedimentary uplands. It is 50 to 65 percent Doney loam and Wayden silty clay loam and 35 to 50 percent Rock outcrop and Shale outcrop. Slopes are mostly 35 to 90 percent, but they range to 30 percent. They are 50 to 200 feet long. The Doney and Wayden soils are on narrow ridges and the upper sides of wide drainageways. They have slopes of 30 to 40 percent. The soils in this complex have profiles similar to the ones described as representative of their respective series, but they are steeper, and on the steepest slopes, the Doney soil in places is less than 20 inches deep over shale.

Included with these soils in mapping are sandstone ledges in the areas of Shale outcrop. Where these sand-



stone ledges occur, slabs of sandstone are scattered down the slope.

Runoff is rapid, and the hazard of erosion is very severe. These soils are used for range, wildlife, recreation, and watershed. Capability unit VIIe-1 dryland; Thin Breaks range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**Doney-Wayden complex, hilly (DOe).**—This complex is made up of rolling to hilly and steep soils in the sedimentary uplands. It is 60 to 75 percent Doney loam and Wayden silty clay loam; 15 to 25 percent Farnuf, Savage, and Shaak soils; and 5 to 15 percent Rock outcrop and Shale outcrop. Slopes are mostly 15 to 35 percent, but they range to 8 percent. The landscape is approaching mature dissection—the ridgetops are rounded and well grassed. The ridges are less than 150 feet wide and are discontinuous, and the valleys are several hundred feet wide and have nearly continuous foot slopes. The Doney and Wayden soils are intermixed on the ridges and hills. They have slopes of 20 to 35 percent. The Farnuf, Savage, and Shaak soils are on short foot slopes and in the bottoms of wide valleys. They have slopes of 8 to 20 percent.

Runoff is rapid, and the hazard of erosion is severe. These soils are used for range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Thin Hilly range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

### Duncom Series

The Duncom series consists of shallow, rolling to very steep, well-drained soils on ridges and hills in the sedimentary uplands. Slopes range from 8 to 90 percent. These soils formed in place from gravelly and channery loam material weathered from the underlying limestone. Elevation ranges from 6,000 to 8,000 feet.

The native vegetation is dryland sedges, cinquefoil, Idaho fescue, club mosses, and elk thistle. Annual precipitation is 20 to 24 inches, the average annual soil temperature is 43° to 45° F, and the frost-free period is 60 to 70 days.

In a representative profile the surface layer is very dark grayish-brown gravelly loam about 4 inches thick. The underlying material is grayish-brown, pale-brown, and very pale brown gravelly and very gravelly loam. Limestone is at a depth of about 18 inches.

Permeability is moderate, and available water capacity is very low. The effective rooting depth is about 20 inches. These soils are used for range, wildlife, recreation, and watershed.

Representative profile of Duncom gravelly loam, in an area of Duncom complex, rolling, in grassland, 400 feet east and 300 feet north of the SW. corner sec. 7, T. 9 S., R. 32 E.

A1—0 to 4 inches, very dark grayish-brown (10YR 3/2) gravelly light loam, very dark brown (10YR 2/3) moist; weak, fine, crumb structure; soft, friable, nonsticky and slightly plastic; many very fine roots; very slightly effervescent in spots; 30 percent (volume) limestone and chert fragments of pebble size; clear, smooth boundary.

C1—4 to 9 inches, grayish-brown (10YR 5/2) gravelly loam, dark brown (10YR 4/3) moist; weak, fine,

blocky structure; slightly hard, friable, slightly sticky and plastic; common very fine roots; strongly effervescent; 30 percent limestone, sandstone, and siltstone fragments of channer and pebble size; gradual, wavy boundary.

C2ca—9 to 13 inches, pale-brown (10YR 6/3) gravelly loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and plastic; few very fine roots; violently effervescent; 40 percent (volume) limestone and sandstone fragments of pebble and channer size; flour lime in thin lime casts on pebbles; gradual, wavy boundary.

C3ca—13 to 18 inches, very pale brown (10YR 8/3) very gravelly loam, pale brown (10YR 6/3) moist; massive; hard, friable, sticky and plastic; few very fine roots; violently effervescent; 55 percent (volume) limestone and sandstone fragments of channer and pebble size; flour lime in thin lime casts of pebbles and channers; abrupt, wavy boundary.

R—18 inches, shattered dolomite.

Depth to bedrock ranges from 10 to 20 inches. Depth to the very strongly calcareous part of the soil ranges from 4 to 10 inches. The A1 and C1 horizons normally range from 10 to 30 percent (volume) coarse limestone and fine-grained sandstone fragments of pebble and channer size, and the lower part of the C horizons, from 40 to 60 percent. In places the A1 horizon is as much as 75 percent coarse fragments. The Cca horizon is pinkish gray, light gray, and white. The soil ranges from 10 to 25 percent clay.

Duncom soils in the Big Horn County Area contain more coarse fragments than typical for the series, but this difference does not alter the use or behavior of the soils.

**Duncom extremely channery loam, rolling (Dp).**—This rolling soil is on broad limestone ridges. Slopes are mostly 12 to 15 percent, but they range to 8 percent. The soil has a profile similar to the one described as representative of the series, but the surface layer is 50 to 75 percent limestone fragments of channer, cobble, and stone size. Included in mapping are spots of Rock outcrop (limestone).

Runoff is medium, and the hazard of erosion is moderate. This soil is used for range, wildlife, watershed, and recreation. Capability unit VIe-1 dryland; Shallow range site, 20- to 24-inch precipitation zone; windbreak suitability group 4.

**Duncom complex, rolling (DR).**—This complex is made up of rolling soils on ridges. It is about 85 percent stony, channery, gravelly, and cobbly Duncom soils and 15 percent Rock outcrop. Slopes are mostly 8 to 15 percent. They are short and in many places are broken by a series of narrow limestone outcrops or ledges. Areas range from 100 to 200 acres in size. The gravelly Duncom soil has the profile described as representative of the Duncom series. The other soils have profiles similar to the ones described as representative of their series, but the surface layer is 5 to 30 percent fragments of channer, stone, or cobble size.

Runoff is medium, and the hazard of erosion is moderate. These soils are used for range, wildlife, watershed, and recreation. Capability unit VIe-1 dryland; Shallow range site, 20- to 24-inch precipitation zone; windbreak suitability group 4.

**Duncom-Tarrete association, rolling (DS).**—This association is made up of rolling to hilly and moderately steep soils in the sedimentary uplands. It is about 50 percent Duncom channery loam, 30 percent Tarrete silty clay loam, and 20 percent Mayflower silt loam and Teton loam. Slopes are mostly 8 to 15 percent, but



they range to 20 percent. The Duncom soil in this association has a profile similar to the one described as representative of the Duncom series, but the surface layer is reddish brown to red. The Tarrete soil has the profile described as representative of the Tarrete series.

Runoff is medium, and the hazard of erosion is severe. These soils are used for range, watershed, recreation, and game range. Capability unit VIe-1 dryland; Shallow range site, 20- to 24-inch precipitation zone; windbreak suitability group 4.

**Duncom-Tarrete association, hilly (DT).**—This association is made up of hilly and steep soils in the sedimentary uplands. It is about 60 percent Duncom channery loam, 30 percent Tarrete silty clay loam, and 15 percent Rock outcrop and Shale outcrop. Slopes are mostly 15 to 25 percent, but they range to 35 percent. The Tarrete soil is on the lower sides of drainageways and hills just above the canyon rim. The Duncom soil in this association has a profile similar to the one described as representative of the Duncom series, but the surface layer is reddish brown. Included in mapping are small areas of Adel, Teton, and Mayflower soils.

Runoff is rapid, and the hazard of erosion is severe. These soils are used for range, watershed, recreation, and game range. Capability unit VIe-1 dryland; Shallow range site, 20- to 24-inch precipitation zone; windbreak suitability group 4.

## Elsac Series

The Elsac series consists of moderately deep, undulating to hilly and steep, well-drained soils on smooth ridges and hills in the sedimentary uplands. Slopes range from 4 to 35 percent. These soils formed in place in clay material weathered from the underlying platy clay shale. Elevation ranges from 3,500 to 4,500 feet.

The native vegetation is mainly western wheatgrass, white loco, vetch, and Hoods phlox. Annual precipitation is 14 to 16 inches, the average annual soil temperature is 45° to 47° F, and the frost-free period is 100 to 110 days.

In a representative profile the surface layer is grayish-brown silty clay about 2 inches thick. The subsoil is grayish-brown clay about 3 inches thick. The substratum is grayish-brown, light brownish-gray, and light olive-gray clay. Clay shale is at a depth of about 34 inches.

Permeability is very slow, and available water capacity is low. The effective rooting is about 30 inches. These soils are used for range, wildlife, recreation, and watershed.

Representative profile of Elsac clay, rolling, in grassland, 200 feet north of the center of sec. 2, T. 8 S., R. 33 E.

A—0 to 2 inches, grayish-brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; strong, thin, platy structure; hard, firm, very sticky and very plastic; common fine roots; weakly effervescent; clear, smooth boundary.

B—2 to 5 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak, coarse, prismatic structure parting to moderate, coarse, blocky; extremely hard, very firm, very sticky and

very plastic; common fine roots between peds; few fine pores; strongly effervescent; few indistinct, fine lime masses; clear, wavy boundary.

C1—5 to 12 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate, coarse, prismatic structure parting to moderate, coarse, blocky; extremely hard, very firm, very sticky and extremely plastic; few fine roots; strongly effervescent; few fine, soft lime masses; gradual, wavy boundary.

C2—12 to 19 inches, light brownish-gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate, coarse, prismatic structure parting to moderate coarse, blocky; extremely hard, very firm, very sticky and extremely plastic; few medium roots; few distinct slickensides; strongly effervescent; few coarse, soft lime masses; gradual, wavy boundary.

C3—19 to 24 inches, light olive-gray (5Y 6/2) clay, olive (5Y 5/3) moist; moderate, medium and coarse, blocky structure; extremely hard, very firm, very sticky and very plastic; common fine roots; few partly weathered shale fragments; strongly effervescent; clear, wavy boundary.

C4cs—24 to 34 inches, light olive-gray (5Y 6/2) clay, olive gray (5Y 4/2) moist; moderate, medium, subangular blocky structure; very hard, firm, very sticky and very plastic; very few fine roots; many partly weathered shale fragments; few coarse gypsum crystals; strongly effervescent; clear, wavy boundary.

C5—34 to 46 inches, platy clay shale.

Depth to shale ranges from 20 to 40 inches. The soil between depths of 10 and 40 inches ranges from 60 to 70 percent clay. The A horizon is grayish brown, olive gray, and light olive brown. The C horizon is grayish brown, light brownish gray, olive gray, light olive brown, and light olive gray. The C3 and C4 horizons range from 5 to 30 percent shale fragments.

**Elsac clay, undulating (Ec).**—This undulating soil is on broad, low hills between drainageways in smooth sedimentary uplands. Slopes are mostly 5 and 6 percent, but they range from 4 to 8 percent. They are 200 to 300 feet long. The soil has a profile similar to the one described as representative of the series, but it is less sloping. Included in mapping are areas of Marias soils.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for range, wildlife, recreation, watershed, and dryfarmed crops. Capability unit IIIe-2 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 3M.

**Elsac clay, rolling (Ed).**—This rolling soil is on hills and ridges and in shallow drainageways in the sedimentary uplands. Slopes range from 8 to 15 percent but are mostly 12 to 15 percent. The soil has the profile described as representative of the series. Included in mapping are narrow bands, 3 to 5 acres in size, of Norbert soils.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for range, wildlife, recreation, watershed, and pasture. Capability unit IVe-2 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 3M.

**Elsac cobbly clay, hilly (EH).**—This hilly and steep soil is on ridges, knolls, and hills of deeply dissected gravelly terraces underlain by shale. Along the deeper valleys and parallel to them, slips and landslides occur and occasionally trap drainage water to form ponds. Slopes are mostly 15 to 25 percent, but they range from 15 to 35 percent. The soil has a profile similar to the



one described as representative of the series, but it is steeper, and fragments of cobble and gravel size are on the surface. Included in mapping are one-half-acre patches of Judith, Windham, and Norbert soils.

Runoff is medium, and the hazard of erosion is slight. This soil is used for range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Thin Hilly range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

### Farnuf Series

The Farnuf series consists of deep, nearly level to strongly sloping, well-drained soils on fans, foot slopes, and terraces. Slopes range from 0 to 15 percent. These soils formed in alluvium. Elevation ranges from 3,300 to 4,200 feet.

The native vegetation is big sagebrush, green needlegrass, Sandberg bluegrass, lupine, and snowberry. Annual precipitation is 14 to 17 inches, the average annual soil temperature is 44° to 46° F, and the frost-free period is 110 to 125 days.

In a representative profile the surface layer is very dark grayish-brown loam about 5 inches thick. The subsoil is dark grayish-brown, grayish-brown, and pale-brown loam and clay loam about 29 inches thick. The substratum is light yellowish-brown loam that extends to a depth of 63 inches or more.

Permeability is moderate, and available water capacity is high. The effective rooting depth is 60 inches or more. These soils are used for dryfarmed and irrigated crops, wildlife, recreation, watershed, and range.

Representative profile of Farnuf loam, 2 to 4 percent slopes, in grassland, 1,980 feet east and 330 feet north of the SW. corner sec. 9, T. 7 S., R. 39 E.

- A11—0 to 2 inches, very dark grayish-brown (10YR 3/2) loam, very dark brown (10YR 2/2) moist; weak, very fine, crumb structure; soft, friable, slightly sticky and slightly plastic; clear boundary.
- A12—2 to 5 inches, very dark grayish-brown (10YR 3/2) loam, very dark brown (10YR 2/2) moist; moderate, medium, platy structure; slightly hard, friable, slightly sticky and slightly plastic; gradual boundary.
- B1—5 to 10 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak, medium, prismatic structure parting to weak, medium, blocky; hard, friable, sticky and plastic; gradual boundary.
- B21—10 to 16 inches, grayish-brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate, medium, prismatic structure parting to moderate, medium, blocky; hard, friable, sticky and plastic; thin, patchy clay films on peds; clear, wavy boundary.
- B22—16 to 24 inches, grayish-brown (10YR 5/2) clay loam, dark brown (10YR 4/3) moist; moderate, medium, prismatic structure parting to moderate, medium, blocky; hard, friable, sticky and plastic; thin, patchy clay films on peds; slightly effervescent; gradual, wavy boundary.
- B3ca—24 to 34 inches, pale-brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak, medium, blocky structure; hard, friable, slightly sticky and plastic; strongly effervescent; network of common fine lime threads; gradual boundary.
- C1ca—34 to 43 inches, light yellowish-brown (2.5Y 6/4) loam, light olive brown (2.5Y 5/4) moist; massive; hard, friable, slightly sticky and plastic; strongly effervescent; few threads of lime; gradual boundary.

C2—43 to 63 inches, light yellowish-brown (2.5Y 6/4) loam, light olive brown (2.5Y 5/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; strongly effervescent.

Depth to calcareous material ranges from 10 to 20 inches. The A and B2 horizons range from 0 to 5 percent shale fragments, and the C horizon, from 0 to 15 percent. Hue ranges from 7.5YR to 2.5Y throughout. The A horizon is dark grayish brown and brown. The B2t horizon is loam or clay loam. The Cca horizon ranges from light brown to light olive brown.

**Farnuf loam, 0 to 2 percent slopes (Fa).**—This nearly level soil is on smooth stream terraces. Areas are 5 to 15 acres in size. The soil has a profile similar to the one described as representative of the series, but it is less sloping. Included in mapping are 1- to 2-acre patches of Frazer soils.

Runoff is slow, and the hazard of erosion is slight. This soil is used for irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIc-2 dryland, IIc-1 irrigated; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Farnuf loam, 2 to 4 percent slopes (Fb).**—This gently sloping soil is on terraces and fans. Areas are 5 to 35 acres in size. Slopes are 3 to 4 percent on the fans and 2 percent on the terraces. They are 150 to 350 feet long. The soil has the profile described as representative of the series. Included in mapping are some areas of soils that have a few red shale fragments in the lower part of the substratum.

Runoff is slow, and the hazard of erosion is moderate. This soil is used for irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIe-2 dryland, IIe-1 irrigated; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Farnuf loam, 4 to 8 percent slopes (Fc).**—This sloping soil is on foot slopes and fans. Areas are 5 to 20 acres in size. Slopes are 4 to 5 percent on the fans and 7 to 8 percent on the upper half of the foot slopes. The soil has a profile similar to the one described as representative of the series, but it is steeper and has a few coarse fragments of red shale in the lower part of the substratum. Included in mapping are small spots of Doney soils.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIIe-2 dryland, IIIe-1 irrigated; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Farnuf-Doney association, sloping (FD).**—This association is made up of strongly sloping soils on fans and foot slopes. It is 65 to 85 percent Farnuf loam and 15 to 25 percent Doney loam. Slopes are mostly 8 to 15 percent, but they range to 4 percent. The Farnuf soil in this association has a profile similar to the one described as representative of the series, but it is steeper. The Doney soil has the profile described as representative of the Doney series. Included in mapping are spots of Macar soils and gravelly Arnegard soils.

Runoff is medium, and the hazard of erosion is moderate. These soils are used for watershed, recreation, wildlife, range, dryfarmed crops, hay, and pasture.



Capability unit IVE-2 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 2M.

### Fergus Series

The Fergus series consists of deep, gently sloping to strongly sloping, well-drained soils on foot slopes, fans, and narrow terraces. Slopes range from 2 to 15 percent. These soils formed in silty clay loam and silt loam alluvium washed from red-colored, fine-grained shale and sandstone. Elevation ranges from 3,800 to 4,600 feet.

The native vegetation is mainly green needlegrass, prairie junegrass, silver sagebrush, cudweed sagewort, snowberry, and lupine. Annual precipitation is 15 to 17 inches, the average annual soil temperature is 44° to 46° F, and the frost-free period is 90 to 110 days.

In a representative profile the surface layer is dark reddish-gray silt loam about 9 inches thick. The subsoil is reddish-brown silt loam and silty clay loam about 22 inches thick. The substratum is reddish-brown and reddish-yellow silt loam that extends to a depth of 62 inches or more.

Permeability is moderately slow, and available water capacity is high. The effective rooting depth is 60 inches or more. These soils are used for range, wildlife, recreation, watershed, dryfarmed crops, hay, and pasture.

Representative profile of Fergus silt loam, 4 to 8 percent slopes, in grassland, 1,300 feet west of the center of sec. 25, T. 6 S., R. 28 E.

- A11—0 to 4 inches, dark reddish-gray (5YR 4/2) silt loam, dark reddish brown (5YR 2/2) moist; weak, medium, crumb structure; slightly hard, very friable, nonsticky and slightly plastic; many very fine and micro roots; gradual, wavy boundary.
- A12—4 to 9 inches, dark reddish-gray (5YR 4/2) silt loam, dark reddish brown (5YR 2/2) moist; weak, coarse, prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; clear, wavy boundary.
- B1—9 to 14 inches, reddish-brown (5YR 4/3) silt loam, dark reddish brown (5YR 3/2) moist; moderate, medium, prismatic structure; hard, friable, sticky and plastic; common very fine roots; clear, wavy boundary.
- B21t—14 to 19 inches, reddish-brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 3/3 crushed, 3/2 coated) moist; weak, medium, prismatic structure parting to moderate, medium, blocky; very hard, friable, sticky and plastic; common very fine roots; many very fine pores; thin, patchy clay films on peds; clear, wavy boundary.
- B22t—19 to 25 inches, reddish-brown (5YR 5/4) silty clay loam, dark reddish brown (5YR 3/3) moist; weak, medium, prismatic structure parting to moderate, medium, blocky; very hard, firm, very sticky and very plastic; many very fine pores; thin, patchy clay films on peds; clear, wavy boundary.
- B3—25 to 31 inches, reddish-brown (5YR 5/5) silty clay loam, reddish brown (5YR 4/5) moist; weak, medium, blocky structure; very hard, firm, sticky and plastic; many very fine pores; clear, wavy boundary.
- C1ca—31 to 38 inches, reddish-brown (5YR 5/5) silt loam, yellowish red (5YR 4/6) moist; weak, coarse, blocky structure; very hard, friable, sticky and plastic; common very fine pores; strongly effervescent; few fine lime threads coating root channels; gradual, wavy boundary.

C2—38 to 62 inches, reddish-yellow (5YR 6/5) silt loam, yellowish red (5YR 4/5) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; strongly effervescent; common fine lime threads.

Depth to calcareous material ranges from 20 to 40 inches. The A horizon is silt loam or loam that ranges from dark brown to dark reddish brown and dark reddish gray in hue of 2.5YR to 7.5YR. The B2t horizon ranges from 35 to 42 percent clay. The Cca horizon ranges from light reddish-brown to brown silt loam to heavy silty clay loam.

**Fergus silt loam, 2 to 4 percent slopes (Fe).**—This soil is on terraces and fans. Areas are 10 to 15 acres in size. The soil has a profile similar to the one described as representative of the series, but it is less sloping. Included in mapping are narrow bands of Darret soils.

Runoff is slow, and the hazard of erosion is moderate. This soil is used for recreation, wildlife, range, hay, and dryfarmed crops. Capability unit IIIe-2 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Fergus silt loam, 4 to 8 percent slopes (Ff).**—This soil is on foot slopes and fans. Slopes are mostly 7 and 8 percent, and they range from 200 to 300 feet long. The soil has the profile described as representative of the series.

Runoff is medium, and the hazard of erosion is moderate. Some areas receive runoff from soils above them. These soils are used for watershed, recreation, wildlife, range, hay, and dryfarmed crops. Capability unit IIIe-2 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Fergus silt loam, 8 to 15 percent slopes (Fg).**—This soil is on foot slopes that surround isolated red hills. Slopes range from 200 to 600 feet long and are mostly 12 to 15 percent. The soil is at elevations of more than 5,000 feet and is slightly cooler than typical for the series, but this difference does not affect use and management of the soil. Included in mapping are areas of Abac soils 1 acre to 3 acres in size.

Runoff is medium, and the hazard of erosion is severe. These soils are used for wildlife, recreation, watershed, range, and pasture. Capability unit IVE-2 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

### Fort Collins Series

The Fort Collins series consists of deep, nearly level to sloping and rolling, well-drained soils on terraces and fans in stream valleys. Slopes range from 0 to 15 percent. These soils formed in loam and clay loam alluvium. Elevation ranges from 2,800 to 3,400 feet.

The native vegetation is mainly blue grama, needle-andthread, big sagebrush, and cheatgrass. Annual precipitation is 12 to 14 inches, the average annual soil temperature is 47° to 49° F, and the frost-free period is 115 to 125 days.

In a representative profile the surface layer is grayish-brown and brown loam about 4 inches thick. The subsoil is brown and grayish-brown clay loam and loam about 18 inches thick. The substratum is light brownish-gray and light-gray loam that extends to a depth of 65 inches or more.

Permeability is moderate, and available water capacity is high. The effective rooting depth is 60 inches



or more. These soils are used for irrigated and dry-farmed crops, watershed, wildlife, recreation, and range.

Representative profile of Fort Collins loam, 2 to 4 percent slopes, in grassland, 330 feet south and 800 feet east of the NW. corner sec. 27, T. 1 N., R. 38 E.

- A—0 to 3 inches, grayish-brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate, medium, platy structure; soft, friable, nonsticky and nonplastic; clear, smooth boundary.
- AB—3 to 4 inches, brown (10YR 5/3) loam, dark grayish brown (10YR 4/2) moist; moderate, medium, platy structure; slightly hard, friable, slightly sticky and slightly plastic; clear, smooth boundary.
- B21t—4 to 9 inches, brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate, medium, prismatic structure parting to moderate, medium, blocky; hard, firm, sticky and slightly plastic; thin, continuous clay films on peds; gradual, wavy boundary.
- B22t—9 to 12 inches, brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; moderate, medium, prismatic structure parting to moderate, medium, blocky; hard, firm, slightly sticky and slightly plastic; thin, patchy clay films on peds; gradual, wavy boundary.
- B3ca—12 to 22 inches, grayish-brown (10YR 5/2) loam, grayish brown (10YR 4/2) moist; weak, prismatic structure parting to weak, medium, blocky; hard, friable, slightly sticky and plastic; strongly effervescent; few fine lime mottles; clear, wavy boundary.
- C1—22 to 27 inches, light brownish-gray (2.5Y 6/2) loam, light olive brown (2.5Y 5/4) moist; weak, coarse, prismatic structure; hard, friable, slightly sticky and slightly plastic; strongly effervescent; few medium and coarse lime mottles; gradual, wavy boundary.
- C2—27 to 33 inches, light brownish-gray (2.5Y 6/2) loam, light olive brown (2.5Y 5/4) moist; weak, coarse, friable, slightly sticky and slightly plastic; strongly effervescent; gradual, wavy boundary.
- C3—33 to 65 inches, light-gray (2.5Y 7/2) loam that grades to silt loam below a depth of 53 inches; massive; strongly effervescent.

Depth to calcareous material ranges from 7 to 12 inches. The upper 24 inches of the soil ranges from 0 to 10 percent coarse fragments. Hue ranges from 10YR to 5Y throughout. The A horizon is light brownish gray and grayish brown. The B2t horizon ranges from grayish brown to olive brown. The Bca horizon is grayish brown and olive. The C horizon is stratified with fine sandy loam, clay loam, and silt loam.

**Fort Collins loam, 0 to 2 percent slopes (Fh).**—This soil is on stream terraces and fans. It has a profile similar to the one described as representative of the series, but it is less sloping. Included in mapping are patches of McRae loam, 1 acre to 2 acres in size.

Runoff is slow, and the hazard of erosion is slight. This soil is used for irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIIc-1 dryland, IIc-1 irrigated; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Fort Collins loam, 2 to 4 percent slopes (Fk).**—This soil is on fans and terraces. Areas are 5 to 40 acres in size. The soil has the profile described as representative of the series.

Included with this soil in mapping are small spots of McRae and Thurlow soils. Also included on gravelly terraces are areas of a soil, similar to this Fort Collins

soil, that in places has strata of loamy sand below a depth of 30 inches.

Runoff is slow, and the hazard of erosion is moderate. This soil is used for irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIIe-3 dryland, IIe-1 irrigated; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Fort Collins loam, 4 to 8 percent slopes (Fm).**—This soil is in tributary drainageways to major stream valleys on foot slopes, fans, and terraces. Areas are 20 to 50 acres in size. Slopes range from 250 to 450 feet long. The soil has a profile similar to the one described as representative of the series, but it is steeper. Included in mapping are narrow bands of McRae soils.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for dryfarmed and irrigated crops, hay, wildlife, recreation, watershed, and range. Capability unit IIIe-3 dryland, IIIe-1 irrigated; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Fort Collins loam, channeled, 4 to 8 percent slopes (Fn).**—This soil is on fans, narrow terraces, and foot slopes. The land surface is dissected by many gullies that are 10 to 30 feet wide. As much as 30 percent of some areas consist of gullies that are 5 to 15 feet deep. Slopes are 2 to 7 percent between the gullies and 8 to 15 percent on the sides of the gullies. The soil has a profile similar to the one described as representative of the series, but it is steeper and has deep gullies.

Included with this soil in mapping are patches of McRae soils, 1 acre to 2 acres in size. These included soils make up about 10 percent of the total area of this mapping unit.

Runoff is rapid, and the hazard of erosion is severe. This soil is used for wildlife, recreation, watershed, range, hay, and pasture. Capability unit IVe-3 dryland; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

## Frazer Series

The Frazer series consists of deep, nearly level to steep, well-drained soils on bottom lands, fans, and low terraces. Slopes range from 0 to 35 percent. These soils formed in silty clay loam and silty clay alluvium washed from mixed shale land. Elevation ranges from 3,300 to 4,300 feet.

The native vegetation is mainly western wheatgrass, green needlegrass, Sandberg bluegrass, western yarrow, and Japanese brome. Annual precipitation is 14 to 16 inches, the average annual soil temperature is 45° to 47° F, and the frost-free period is 105 to 120 days.

In a representative profile the surface layer is grayish-brown silty clay loam about 13 inches thick. The underlying material is grayish-brown, brownish-gray, and light yellowish-brown silty clay loam and silt loam that extends to a depth of more than 65 inches.

Permeability is slow, and available water capacity is high. The effective rooting depth is 60 inches or more. These soils are used for irrigated and dryfarmed crops, wildlife, recreation, watershed, and range.

Representative profile of Frazer silty clay loam, in grassland, 900 feet east and 1,500 feet north of the SW. corner sec. 22, T. 5 S., R. 35 E.

- A1—0 to 13 inches, grayish-brown (2.5Y 5/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; moderate, fine, subangular blocky structure; hard, friable, sticky and plastic; many very fine roots; many very fine pores; slightly effervescent; gradual, wavy boundary.
- C1—13 to 20 inches, grayish-brown (2.5Y 5/2) heavy silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak, medium and fine, subangular blocky structure; very hard, firm, very sticky and very plastic; common very fine roots; common very fine tubular pores; slightly effervescent; gradual, wavy boundary.
- C2—20 to 38 inches, brownish-gray (2.5Y 6/2) silty clay loam, olive brown (2.5Y 4/3) moist; massive; hard, friable, sticky and plastic; few very fine roots; common very fine tubular pores; slightly effervescent; few fine, soft lime masses; gradual, wavy boundary.
- C3—38 to 65 inches, light yellowish-brown (2.5Y 6/3), stratified silt loam and silty clay loam, light olive brown (2.5Y 5/3) moist; massive; hard, friable, sticky and plastic; few very fine tubular pores; slightly effervescent.

The soil between depths of 10 and 40 inches is silty clay loam, clay loam, or silty clay. Hue is 2.5Y or 10YR throughout. The A horizon is dark grayish brown and grayish brown.

**Frazer silty clay loam (Fo).**—This soil is in old stream channels and oxbows on low terraces and flood plains. Slopes are 0 to 2 percent. Areas range from 3 to 20 acres in size. The soil has the profile described as representative of the series.

Runoff is slow, and the hazard of erosion is slight. Flooding is a hazard in places, and in others the water table is at a depth of 5 feet early in summer along perennial streams. In places the strata of silty clay below a depth of 30 inches have visible salt crystals and are slightly saline. This soil is used for dryfarmed and irrigated crops, hay, wildlife, recreation, and range. Capability unit IIE-2 dryland, IIS-1 irrigated; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Frazer silty clay loam, saline (Fr).**—This soil is on flood plains, terraces, and fans in irrigated areas. Slopes are 0 to 2 percent on the flood plains and terraces and 3 to 4 percent on the fans. The soil has a profile similar to the one described as representative of the series, but it is moderately saline affected in the upper 20 inches and has a few greenish-gray, gray, and olive-yellow mottles.

Runoff is slow, and the hazard of erosion is slight. A seasonal high water table is typically at a depth of 4 to 5 feet. This soil is used for irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIIs-2 dryland; Saline Lowland range site, 10- to 14-inch precipitation zone; windbreak suitability group 2S.

**Frazer silty clay (Fs).**—This nearly level soil is on flood plains and low terraces. Slopes are 0 to 1 percent. The soil has a profile similar to the one described as representative of the series, but the surface layer is silty clay, and there are no strata of material coarser than silty clay loam below a depth of 10 inches. Also, in some places coarse fragments of gravel size are be-

low a depth of 3 feet, and in others there are gray and olive-yellow mottles and a few salt crystals.

Runoff is slow, and the hazard of erosion is slight. Flooding occurs in places in the larger stream valleys. This soil is used for dryfarmed and irrigated crops, hay, wildlife, recreation, and range. Capability unit IIS-2 dryland, IIS-1 irrigated; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Frazer and Korchea soils, channeled (FT).**—This undifferentiated soil group is made up of Frazer silty clay loam and Korchea loam on narrow, level valley bottoms along intermittent streams. It is on flood plains, low terraces, straight-sided stream channels, and small fans at the mouths of side drainageways. Areas are 200 to 500 feet wide and as much as 1½ miles long. The flood plains and terraces are level, and the channeled and eroded edges of fans and breaks have slopes of 15 to 35 percent. The soils in this mapping unit have profiles similar to the ones described as representative of their respective series, but they are steeper.

Runoff is medium, and the hazard of erosion is severe. Runoff actively cuts channels. In places the soils are subject to overflow, but the stream channel generally carries all the runoff. These soils are used for range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

## Gilt Edge Series

The Gilt Edge series consists of deep, nearly level to gently sloping and undulating, well-drained, sodium-affected soils on terraces. Slopes range from 0 to 4 percent. These soils formed in alkaline alluvium. Elevation ranges from 2,900 to 3,600 feet.

The native vegetation is mainly western wheatgrass, Sandberg bluegrass, big sagebrush, needleandthread, fringed sagewort, and blue grama. Annual precipitation is 12 to 14 inches, the average annual soil temperature is 47° to 49° F, and the frost-free period is 115 to 125 days.

In a representative profile the surface layer is light brownish-gray and grayish-brown loam and silt loam about 3 inches thick. The subsoil is grayish-brown clay and silty clay about 13 inches thick. The substratum is pale-yellow silty clay and silty clay loam that extends to a depth of 60 inches or more.

Permeability is slow, and available water capacity is high. The effective rooting depth is 40 inches or more. These soils are used for dryfarmed crops, wildlife, recreation, and range. They are suitable for irrigation.

Representative profile of Gilt Edge silty clay loam, 0 to 2 percent slopes, in grassland, 660 feet north and 300 feet east of the SW. corner sec. 1, T. 3 S., R. 32 E.

- A21—0 to 1 inch, light brownish-gray (10YR 6/2) loam, dark brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and slightly plastic; many vesicular pores; abrupt, smooth boundary.
- A22—1 inch to 3 inches, grayish-brown (10YR 5/2) silt loam, dark brown (10YR 3/3) moist; moderate, medium, platy structure; slightly hard, friable, slightly sticky and plastic; clean sand grains coating the tops of the plates are 10YR 6/2 when dry; abrupt, smooth boundary.



- B21t—3 to 6 inches, grayish-brown (10YR 5/2) crushed, 5/3 ped) clay, dark grayish brown (10YR 4/2) moist; moderate, fine, prismatic structure parting to strong, fine, blocky; very hard, firm, very sticky and very plastic; moderately thick, patchy clay films on peds; few fine pores; clear, smooth boundary.
- B22t—6 to 10 inches, grayish-brown (10YR 5/2 crushed, 5/3 ped) clay, dark grayish brown (10YR 4/2 crushed, 4/3 ped) moist; moderate, medium, prismatic structure parting to strong, medium, blocky; very hard, firm, very sticky and very plastic; thin, patchy clay films on peds; few fine pores; slightly effervescent; clear, smooth boundary.
- B3ca—10 to 16 inches, grayish-brown (2.5Y 6/2) silty clay, light olive brown (2.5Y 5/4) moist; moderate, medium, prismatic structure parting to moderate, medium, blocky; very hard, firm, very sticky and very plastic; strongly effervescent; common medium lime masses; clear, wavy boundary.
- C1—16 to 27 inches, pale-yellow (2.5Y 7/4) silty clay, light yellowish brown (2.5Y 6/4) moist; weak, coarse, prismatic structure parting to weak, coarse, blocky; very hard, firm, very sticky and very plastic; strongly effervescent; common fine lime threads and masses; gradual, wavy boundary.
- C2—27 to 42 inches, pale-yellow (2.5Y 7/4) silty clay loam, light yellowish brown (2.5Y 6/4) moist; massive; very hard, friable, sticky and very plastic; strongly effervescent; gradual, wavy boundary.
- C3—42 to 60 inches, pale-yellow (2.5Y 7/4) silty clay loam, light yellowish brown (2.5Y 6/4) moist; massive; very hard, friable, sticky and plastic; strongly effervescent.

The A horizon is loam, silt loam, and silty clay loam. The B2t horizon ranges from 50 to 60 percent clay and is light olive brown, grayish brown, dark grayish brown, and brown. The C horizon ranges from pale brown to pale yellow in hue of 5Y to 10YR.

#### **Gilt Edge silty clay loam, 0 to 2 percent slopes (Gc).**

—This nearly level soil is on high gravelly terraces. It has the profile described as representative of the series. Included in mapping are spots of Shonkin and Hydro soils, 1 acre to 2 acres in size.

Runoff is slow, and the hazard of erosion is slight. This soil is used for irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IVs-2 dryland, IVs-1 irrigated; Dense Clay range site, 10- to 14-inch precipitation zone; windbreak suitability group 2S.

#### **Gilt Edge silty clay loam, 2 to 4 percent slopes (Gd).**

—This gently sloping soil is on low ridges, knolls, and crests of broad undulations on high gravelly terraces and benches. Slopes range from 50 to 200 feet long. Shallow drainageways near the terrace edge have slopes of 3 to 4 percent. The soil has a profile similar to the one described as representative of the series, but it is steeper.

Included with this soil in mapping are small areas of Shonkin, Hesper, Keiser, and Hydro soils. Also included are small areas of soils that have gravel covering 15 to 20 percent of the surface and small areas of soils that are underlain by gravelly sand at a depth of 30 inches.

Runoff is slow, and the hazard of erosion is slight. Areas of the included Shonkin soil are subject to flooding when the snow melts in spring. This soil is used for irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IVs-2 dryland, IVe-1 irrigated; Dense Clay range site, 10- to 14-inch precipitation zone; windbreak suitability group 2S.

#### **Gilt Edge-Bone complex, 0 to 1 percent slopes (Ge).**

—This complex is made up of nearly level soils on gravelly terraces and benches. It is 50 to 60 percent Gilt Edge silty clay loam, 25 to 35 percent Bone and Talag clays, and 0 to 15 percent Shonkin, Keiser, and Colby silty clay loams. The Bone and Talag soils are in microdepressions and slickspots and have a sparse, stunted plant cover. The Shonkin soil is in shallow potholes 1/8 to 1 acre in size. The Keiser and Colby soils are on slight ridges and crests of surface undulations and along terraces. The Keiser and Colby soils in this complex have profiles similar to the ones described as representative of their respective series, but they are less sloping.

Runoff is slow, and the hazard of erosion is slight. The Shonkin soil is briefly ponded when the snow melts in spring. These soils are used for irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IVs-2 dryland, IVs-1 irrigated; Pan Spots range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

#### **Gilt Edge-Bone complex, 1 to 4 percent slopes (Gf).**

—This complex is made up of nearly level and gently sloping soils on gravelly terraces. It is about 40 percent Gilt Edge silty clay loam, 30 percent Bone and Talag clays, and 30 percent Shonkin, Keiser, and Colby soils. The Bone and Talag soils are in microdepressions and slickspots and have a sparse, stunted plant cover. The Shonkin soil is in shallow potholes where runoff collects. The Keiser and Colby soils are on the narrow crests of ridges and along terraces.

Runoff is slow, and the hazard of erosion is slight. These soils are used for irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IVs-2 dryland, IVe-1 irrigated; Pan Spots range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

### **Glenberg Series**

The Glenberg series consists of deep, nearly level to strongly sloping and undulating to rolling, well-drained soils on low terraces, fans, foot slopes, and flood plains. Slopes are mostly 0 to 8 percent, but they range to 15 percent. These soils formed in mixed sandy loam and loam alluvium. Elevation ranges from 2,800 to 3,500 feet.

The native vegetation is mainly bluegrass, wild rose, needleandthread, western wheatgrass, curlycup gumweed, and cheatgrass. Annual precipitation is 12 to 14 inches, the average annual soil temperature is 47° to 49° F, and the frost-free period is 120 to 125 days.

In a representative profile the surface layer is grayish-brown fine sandy loam and sandy loam about 5 inches thick. The underlying material is grayish-brown and light brownish-gray fine sandy loam, loamy sand, and silt loam that extends to a depth of 60 inches or more.

Permeability is moderately rapid, and available water capacity is moderate. The effective rooting depth is 60 inches or more. These soils are used for irrigated crops, pasture, wildlife, recreation, and watershed.

Representative profile of Glenberg fine sandy loam, 0 to 2 percent slopes, in a cultivated area, 1,320 feet



east and 1,800 feet south of the NW. corner sec. 5, T. 3 N., R. 34 E.

- Ap1—0 to 2 inches, grayish-brown (2.5Y 5/2) fine sandy loam, very dark grayish brown (2.5Y 3/2) moist; weak, coarse, platy structure; slightly hard, very friable, nonsticky and slightly plastic; few fine roots; slightly effervescent; abrupt, smooth boundary.
- Ap2—2 to 5 inches, grayish-brown (2.5Y 5/2) sandy loam, dark grayish brown (2.5Y 4/2) moist; moderate, very coarse, platy structure; slightly hard, very friable, nonsticky and slightly plastic; few fine roots; very fine pores; strongly effervescent; abrupt, smooth boundary.
- C1—5 to 14 inches, grayish-brown (2.5Y 5/2) loamy sand, dark grayish brown (2.5Y 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; few fine roots; strongly effervescent; clear, wavy boundary.
- C2—14 to 22 inches, light brownish-gray (2.5Y 6/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, very friable, nonsticky and slightly plastic; few fine roots; strongly effervescent; clear, wavy boundary.
- C3—22 to 60 inches, light brownish-gray (2.5Y 6/2) stratified fine sandy loam, loamy sand, and silt loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, very friable, nonsticky and slightly plastic; strongly effervescent.

The soil between depths of 10 and 40 inches is sandy loam or fine sandy loam that contains a few thin bands of silt loam and loamy sand and ranges from 10 to 18 percent clay. Hue ranges from 2.5Y to 10YR throughout.

**Glenberg fine sandy loam, 0 to 2 percent slopes (Gg).**

—This soil is on flood plains and stream terraces. It has the profile described as representative of the series.

Included with this soil in mapping are areas of soils that in places are underlain by gravelly sand at a depth of 20 to 40 inches. These areas are indicated on the detailed soil map by a special symbol.

Runoff is slow, and the hazard of erosion is moderate. This soil is subject to spring flooding. It is used for irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IVE-3 dryland, IIS-2 irrigated; Sandy range site, 10- to 14-inch precipitation zone; windbreak suitability group 2M.

**Glenberg fine sandy loam, 2 to 4 percent slopes (Gh).**

—This soil is on fans and terraces. Slopes are smooth and range from 300 to 500 feet long. The soil has a profile similar to the one described as representative of the series, but it is steeper.

Runoff is slow, and the hazard of erosion is moderate. This soil is used for irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IVE-3 dryland, IIE-2 irrigated; Sandy range site, 10- to 14-inch precipitation zone; windbreak suitability group 2M.

**Glenberg fine sandy loam, 4 to 8 percent slopes (Gk).**

—This soil is on foot slopes and fans. Areas range from 10 to 30 acres in size. Slopes are 250 to 400 feet long. The soil has a profile similar to the one described as representative of the series, but it is steeper. Included in mapping are areas of Alice soils, 1 acre to 5 acres in size.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for irrigated and dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IVE-3 dryland, IIIE-2 irrigated; Sandy

range site, 10- to 14-inch precipitation zone; windbreak suitability group 2M.

**Glenberg loam, 0 to 2 percent slopes (Gm).**—This soil is on flood plains and low terraces. It has a profile similar to the one described as representative of the series, but the surface layer is loam 6 to 10 inches thick.

Runoff is slow, and the hazard of erosion is moderate. The soil is subject to overflow when the snow melts in spring. It is used for dryfarmed and irrigated crops, hay, wildlife, recreation, and range. Capability unit IVE-3 dryland, IIS-2 irrigated; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

## Grail Series

The Grail series consists of deep, nearly level to steep and hilly, well-drained soils on terraces and fans. Slopes range from 0 to 35 percent. These soils formed in silty clay loam and silty clay alluvium. Elevation ranges from 3,500 to 5,000 feet.

The native vegetation is mainly green needlegrass, western wheatgrass, plum, thornapple, and Sandberg bluegrass. Annual precipitation is 14 to 16 inches, the average annual soil temperature is 45° to 47° F, and the frost-free period is 100 to 115 days.

In a representative profile the surface layer is dark-grayish-brown clay loam about 8 inches thick. The subsoil is grayish-brown and light olive-gray silty clay loam and silty clay about 22 inches thick. The substratum is light-gray and pale-yellow silty clay and silty clay loam that extends to a depth of 65 inches or more.

Permeability is moderately slow, and available water capacity is moderate or high. The effective rooting depth is 60 inches or more. These soils are used for dryfarmed and irrigated crops, watershed, wildlife, recreation, and range.

Representative profile of Grail clay loam, 0 to 2 percent slopes, in a cultivated area, 1,600 feet north and 1,320 feet west of the SE. corner sec. 19, T. 7 S., R. 39 E.

- Ap1—0 to 2 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate, thin, platy structure; hard, friable, sticky and plastic; many fine and very fine roots; abrupt, smooth boundary.
- Ap2—2 to 8 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate, thin, platy structure; hard, firm, sticky and plastic; common very fine roots; clear, smooth boundary.
- B21t—8 to 15 inches, grayish-brown (2.5Y 5/2) heavy silty clay loam, very dark grayish brown (2.5Y 3/2) moist; moderate, medium, prismatic structure parting to moderate, medium, blocky; very hard, firm, very sticky and plastic; common very fine roots; common very fine pores; moderately thick, patchy clay films on peds; clear, wavy boundary.
- B22t—15 to 26 inches, grayish-brown (2.5Y 5/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; weak, medium, prismatic structure parting to strong, medium and fine, blocky; very hard, very firm, very sticky and very plastic; common very fine roots; common very fine pores; moderately thick, patchy clay films on peds; clear, wavy boundary.
- B3ca—26 to 30 inches, light olive-gray (5Y 6/2) silty clay,



olive (5Y 5/3) moist; weak, medium, prismatic structure parting to weak, fine and medium, blocky; hard, firm, very sticky and very plastic; few very fine roots; few very fine pores; strongly effervescent; many fine and medium, soft lime masses; gradual, wavy boundary.

C1ca—30 to 38 inches, light-gray (5Y 7/2) silty clay, olive (5Y 5/3) moist; massive; hard, firm, very sticky and very plastic; very few very fine roots; common very fine pores; strongly effervescent; many medium, soft lime masses; gradual, wavy boundary.

C2—38 to 65 inches, pale-yellow (2.5Y 7/4) heavy silty clay loam, light olive brown (2.5Y 5/4) moist; massive; hard, firm, very sticky and very plastic; common very fine pores; strongly effervescent; common fine, soft lime masses.

The A and B2t horizons range from 24 to 34 inches in combined thickness. The A horizon has hue of 10YR and 2.5Y and chroma of 2 or 1. It is clay loam or silty clay. The B2t horizon is 38 to 50 percent clay. The Cca horizon ranges from pale olive to light yellowish brown in hue of 2.5Y and 5Y. In places the lower part of the C horizon is stratified with thin lenses of silty clay loam, silt loam, and silty clay.

**Grail clay loam, 0 to 2 percent slopes (Gn).**—This soil is on terraces. Areas are 10 to 20 acres in size. Slopes are mostly smooth and are 1 percent or less. Locally, old meanders or channel scars are evident. The soil has the profile described as representative of the series. Included in mapping are areas of soils that have a surface layer of silty clay loam.

Runoff is slow, and the hazard of erosion is slight. In places the water table is at a depth of 4 to 5 feet in spring. This soil is used for irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIc-2 dryland, IIs-1 irrigated; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Grail clay loam, 2 to 8 percent slopes (Go).**—This soil is in narrow bands on fans and terraces. Slopes range from 150 to 300 feet long. Slopes are 2 percent on the terraces and 4 percent on the fans. The soil has a profile similar to the one described as representative of the series, but it is steeper. Included in mapping are areas of soils that have a surface layer of silty clay loam.

Runoff is medium, and the hazard of erosion is moderate. Most areas receive additional moisture through runoff from steeper soils above them or from tributary drainageways. This soil is used for irrigated and dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIIe-2 dryland, IIIe-1 irrigated; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Grail clay loam, 8 to 15 percent slopes (Gr).**—This soil is in small areas on valley sides and at the heads of major valleys. In places it is in a band above less steep Grail soils. Slopes are about 200 feet long and are mostly 12 to 15 percent. The soil has a profile similar to the one described as representative of the series, but it is steeper. Included in mapping are small spots of Wayden silty clay loam.

Runoff is rapid, and the hazard of erosion is moderate. This soil is used for dryfarmed crops, wildlife, recreation, watershed, range, and hay. Capability unit IVe-2 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Grail clay loam, 15 to 35 percent slopes (GS).**—This

soil is between a series of sharp ridges that form the divides between major drainageways. Small drainageways have cut through the areas at right angles to the ridges. The soil has a profile similar to the one described as representative of the series, but it is steeper. The native vegetation is thornapple, mountain maple, and snowberry.

Included with this soil in mapping are Wayden soils on ridges. Also included are small areas of Regent and Savage soils.

Runoff is rapid, and the hazard of erosion is severe. This soil is used for range, watershed, recreation, and game range. Capability unit VIe-1 dryland; Thin Hilly range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**Grail silty clay, 0 to 2 percent slopes (Gt).**—This soil is on terraces and fans. Areas are 15 acres in size. The soil has a profile similar to the one described as representative of the series, but the surface layer is silty clay, and the substratum has strata of red silt and silty clay loam.

Runoff is slow, and the hazard of erosion is slight. This soil is used for dryfarmed and irrigated crops, hay, wildlife, recreation, and range. Capability unit IIIe-2 dryland, IIs-1 irrigated; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

## Hanson Series

The Hanson series consists of deep, rolling and strongly sloping to very steep, well-drained soils on foot slopes below rock ledges and on limestone hills in sedimentary uplands. Slopes range from 8 to 70 percent. These soils formed in highly calcareous very gravelly loam alluvium. Elevation ranges from 6,000 to 8,500 feet.

The native vegetation is mainly dogbane, spike fescue, sedges, horizontal juniper, bluebunch wheatgrass, and Douglas-fir. Annual precipitation is 19 to 24 inches, the average annual soil temperature is 42° to 44° F, and the frost-free period is 60 to 75 days.

In a representative profile the surface layer is dark-brown gravelly loam about 11 inches thick. The underlying material is brown to very pale brown very gravelly loam that extends to a depth of 108 inches or more.

Permeability and available water capacity are moderate. The effective rooting depth is 60 inches or more. These soils are used for range, game range, watershed, woodland, and recreation.

Representative profile of Hanson gravelly loam, in an area of Hanson-Babb association, very steep, in grassland, 300 feet north and 200 feet east of the SW. corner sec. 26, T. 8 S., R. 31 E.

A11—0 to 7 inches, dark-brown (10YR 3/3) gravelly loam, very dark brown (10YR 2/2) moist; weak, very fine, granular structure; soft, friable, slightly sticky and slightly plastic; many very fine and micro and few medium roots; 30 percent (volume) angular and semiround limestone fragments of pebble and cobble size; clear, wavy boundary.

A12—7 to 11 inches, dark-brown (10YR 4/3) gravelly loam, dark brown (10YR 3/3) moist; massive; soft, friable, slightly sticky and slightly plastic; common very fine and micro and few medium roots; 40

percent (volume) limestone fragments of pebble and cobble size; slightly effervescent; thin lime coatings on the pebbles and cobbles; clear, wavy boundary.

C1ca—11 to 18 inches, brown (10YR 5/3) very gravelly loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine and micro roots; 50 percent (volume) limestone fragments of pebble and cobble size; strongly effervescent; thin lime coatings and thick lime pendants on the bottoms of the pebbles and cobbles; gradual, wavy boundary.

C2ca—18 to 30 inches, pale-brown (10YR 6/3) very gravelly heavy loam, brown (10YR 5/3) moist; massive; hard, friable, sticky and plastic; common very fine and micro roots; 50 percent (volume) limestone fragments of pebble and cobble size; violently effervescent; common fine, soft lime masses and lime casts on the bottoms of the pebbles and cobbles; gradual, wavy boundary.

C3ca—30 to 108 inches, very pale brown (10YR 7/3) very gravelly loam, brown (10YR 5/3) moist; massive; soft, very friable, slightly sticky and plastic; few micro roots in upper part; 65 percent (volume) limestone fragments of pebble and cobble size; violently effervescent; lime casts on the bottoms of the pebbles and cobbles.

The soil ranges from 25 to 75 percent, by volume, coarse fragments of limestone, siltstone, and chalcedony, but they average 35 to 60 percent when mixed. The A horizon is grayish brown and brown in hue of 7.5YR to 2.5Y. The Cca horizon has a 15- to 15-percent calcium carbonate equivalent in the soil fraction less than 2 millimeters in diameter. It is pink and pale yellow.

**Hanson extremely stony loam, rolling (HA).**—This soil is on ridges between deep mountain valleys. Slopes are mostly 10 to 15 percent, but they range to 8 percent. The soil has a profile similar to the one described as representative of the series, but the surface is 30 to 40 percent stones and boulders as much as 2 to 3½ feet in diameter.

Runoff is slow, and the hazard of erosion is moderate. This soil is used for range, watershed, wildlife, and recreation. Capability unit VIIe-1 dryland; Silty range site, 20- to 24-inch precipitation zone; windbreak suitability group 4.

**Hanson-Babb association, very steep (HB).**—This association is made up of very steep Hanson gravelly loam and Babb silt loam on side slopes of steep mountain valleys and canyons. Areas are mostly 80 to 500 acres in size and on north- and east-facing slopes. Slopes are mostly more than 45 percent, but they range to 35 percent in the steep valley bottoms. In some areas there are isolated low pinnacles and discontinuous ledges of Rock outcrop. The amount of each soil in any mapped area varies with the steepness of slope and the amount of Rock outcrop. Where the rock ledges are present, the Hanson soil extends down the side slopes 200 to 400 feet and has slopes of more than 60 percent. The Babb soil is on the less steep parts of the valley bottoms and has slopes of 35 to 50 percent. The Hanson soil in this association has the profile described as representative of the Hanson series.

Runoff is slow, and the hazard of erosion is moderate. These soils are used for woodland, game range, watershed, range, and recreation. The principal tree species are Douglas-fir, Engelmann spruce, and subalpine fir. A few aspen, cottonwoods, alder, and moun-

tain maple grow on the steep valley bottoms. The average site index for Douglas-fir is 60.

Timber harvest on these soils is limited by steep slopes and difficult access. Most of the soils are below thick rock canyon rims that bar road construction. Valley bottoms are narrow and subject to severe erosion if used for access roads. Controlling fire is a major concern of management. There are small infestations of bark beetles in the Big Horn Mountain. Capability unit VIIs-1 dryland; not placed in a range site or windbreak suitability group.

## Harvey Series

The Harvey series consists of deep, gently undulating to rolling, well-drained soils on fans, benches, and terraces. Slopes range from 2 to 15 percent. These soils formed in highly calcareous alluvium. Elevation ranges from 2,900 to 4,400 feet.

The native vegetation is mainly big sagebrush, black sagebrush, bluebunch wheatgrass, prairie junegrass, and Hoods phlox. Annual precipitation is 10 to 14 inches, the average annual soil temperature is 47° to 49° F, and the frost-free period is 115 to 125 days.

In a representative profile the surface layer is pale-brown loam about 3 inches thick. The subsoil is brown loam about 4 inches thick. The substratum is pale-brown loam in the upper part and very pale brown loam and pink gravelly loam in the lower part. It extends to a depth of 50 inches or more.

Permeability and available water capacity are moderate. The effective rooting depth is 40 inches or more. These soils are used for range, wildlife, recreation, watershed, and dryfarmed and irrigated crops.

Representative profile of Harvey loam, undulating, in grassland, 660 feet south and 500 feet west of center of sec. 12, T 3 N., R. 33 E.

A—0 to 3 inches, pale-brown (10YR 6/3) loam, dark brown (10YR 3/3) moist; moderate, medium, platy structure; slightly hard, friable, slightly sticky and slightly plastic; few (1/16 inch to 1 inch in diameter) limestone and chert fragments of pebble size on the surface; clear, smooth boundary.

B—3 to 7 inches, brown (10YR 5/3) heavy loam, dark brown (10YR 4/3) moist; weak, medium, prismatic structure parting to weak, medium, blocky; hard, friable, sticky and plastic; few limestone fragments of pebble size throughout; clear, wavy boundary.

C1—7 to 12 inches, pale-brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak, coarse, prismatic structure; hard, friable, sticky and plastic; strongly effervescent; hard, friable, sticky and plastic; strongly effervescent; few limestone fragments of pebble size throughout; clear, wavy boundary.

C2ca—12 to 23 inches, very pale brown (10YR 7/3) heavy loam, light yellowish brown (10YR 6/4) moist; moderate, medium, subangular blocky structure; hard, friable, sticky and plastic; violently effervescent; common coarse and medium segregated lime masses; clear, wavy boundary.

C3—23 to 31 inches, very pale brown (10YR 7/3) loam, yellowish brown (10YR 5/4) moist; massive; hard, friable, sticky and plastic; 10 percent (volume) limestone fragments of pebble size; strongly effervescent; few medium segregated lime mottles; gradual, wavy boundary.

C4—31 to 43 inches, pink (7.5YR 7/3) gravelly loam, light brown (7.5YR 6/4) moist; massive; hard, friable, sticky and plastic; 30 percent (volume) limestone



fragments of pebble size; strongly effervescent; clear, irregular boundary.  
 C5—43 to 50 inches, pink (7.5YR 7/3) very gravelly loam, light brown (7.5YR 6/4) moist; massive; soft, very friable, nonsticky and nonplastic; 60 percent (volume) limestone fragments of gravel size; strongly effervescent.

Depth to calcareous material is 2 to 8 inches. The soil between depths of 10 and 40 inches ranges from 0 to 35 percent coarse fragments. Hue ranges from 7.5YR to 2.5Y, and chroma is 2 or 3. The A horizon is grayish-brown and brown loam and gravelly loam. The Cca horizon is light brown, light gray, and pale yellow. It has a 15- to 35-percent calcium carbonate equivalent.

**Harvey loam, gently undulating (Hca).**—This gently undulating soil is on terraces, benches, fans, and foothills. Areas range from 20 to 200 acres in size. Slopes are mostly 2 and 3 percent, but they range to 4 percent. The soil has a profile similar to the one described as representative of the series, but it is less sloping, in places the substratum is weak red below a depth of 20 inches, and coarse fragments of limestone are below a depth of 40 inches.

Runoff is slow, and the hazard of erosion is slight. This soil is used for irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIIe-3 dryland, IIe-1 irrigated; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 3L.

**Harvey loam, undulating (Hcb).**—This soil is on narrow, rounded ridges and low mounds separated by shallow drainageways on fans and eroded parts of old dissected terraces. Slopes are 4 to 5 percent on the ridgetops, mounds, and shallow drainageways and 6 to 8 percent on the sides of the high ridges and deep drainageways. The soil has the profile described as representative of the series.

Included with this soil in mapping are spots of Clapper gravelly loam and Toluca clay loam. The Clapper soil is on sharp ridges and the edges of deep drainageways.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for dryfarmed and irrigated crops, hay, wildlife, recreation, watershed, and range. Capability unit IIIe-3 dryland, IIIe-1 irrigated; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 3L.

**Harvey loam, rolling (Hcc).**—This soil is on eroded parts of benches and fans. Areas are typically small and in many places are separated by narrow drainageways. Local relief is 20 to 30 feet. Slopes are 6 to 7 percent on the wide ridges between shallow drainageways and 10 to 15 percent on narrow ridges between deep drainageways. Slopes range from 75 to 200 feet long. The soil has a profile similar to the one described as representative of the series, but it is steeper. Included in mapping are spots of Harvey gravelly loam, Colby silty clay loam, and Clapper gravelly loam.

Runoff is medium, and the hazard of erosion is severe. This soil is used mostly for range, wildlife, recreation, and watershed. A few small areas are used for dryfarmed crops and hay. Capability unit IVe-3 dryland; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 3L.

**Harvey gravelly loam, undulating (Hd).**—This soil is on gravelly ridgetops and foot slopes along the moun-

tain fronts. Areas range from 10 to 250 acres in size. Slopes are mostly 4 to 8 percent, but they range to 2 percent. The soil has a profile similar to the one described as representative of the series, but the surface layer is gravelly loam, the coarse fragments are mainly limestone, and the underlying material below a depth of 30 inches is light reddish brown or pink. Included in mapping are small spots of Stormitt soils.

Runoff is rapid, and the hazard of erosion is moderate. This soil is suited to range, wildlife, recreation, watershed, hay, and dryfarmed crops. Capability unit IIIe-3 dryland; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 3L.

**Harvey complex, undulating (He).**—This complex is made up of undulating soils on remnants of old terraces or benches. It is about 45 percent Harvey gravelly loam, 45 percent Harvey loam, and 0 to 10 percent Stormitt soils and red Shale outcrop. Areas of these soils are 5- to 10-acre islands elevated 15 to 40 feet above the surface of more recent deposits. Slopes are mostly 4 to 8 percent. Harvey gravelly loam is on the higher part of the landscape and is surrounded by Harvey loam. The Stormitt soil has slopes of 8 to 10 percent and is in bands along the narrow drainageways. Its surface layer is 30 to 40 percent stones and boulders. The red Shale outcrop is in a band below the island of the original terraces. Shale outcrop has slopes of 15 to 25 percent that are 50 to 125 feet long. The Harvey soils have profiles similar to the one described as representative of the series, but the lower part of the underlying material is 30 to 40 percent coarse fragments, the surface layer is 15 to 30 percent coarse fragments, and loose very gravelly loam alluvium is at a depth of 30 to 50 inches.

Runoff is rapid, and the hazard of erosion is moderate. These soils are suited to pasture, hay, wildlife, recreation, watershed, and dryfarmed crops. Capability unit IIIe-3 dryland; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 3L.

## Haverson Series

The Haverson series consists of deep, nearly level to steep, well-drained soils on flood plains and low terraces. Slopes range from 0 to 35 percent. These soils formed in stratified loam, silt loam, and fine sandy loam alluvium. Elevation ranges from 2,800 to 3,300 feet.

The native vegetation is mainly Sandberg bluegrass, needleandthread, silver sagebrush, curlycup gumweed, and cudweed sagewort. Annual precipitation is 12 to 14 inches, the average annual soil temperature is 47° to 49° F, and the frost-free period is 115 to 125 days.

In a representative profile the surface layer is grayish-brown loam about 12 inches thick. The underlying material is light yellowish-brown and light brownish-gray stratified silt loam, loam, and sandy loam that extends to a depth of 60 inches or more.

Permeability is moderate, and available water capacity is high. The effective rooting depth is 60 inches or more. These soils are used for irrigated and dryfarmed crops, wildlife, recreation, watershed, and range.



Representative profile of Haverson loam, 0 to 2 percent slopes, in a cultivated field, 660 feet east and 300 feet south of the NW. corner sec. 20, T. 3 N., R. 34 E.

- Ap1—0 to 4 inches, grayish-brown (2.5Y 5/2) heavy loam, dark grayish brown (2.5Y 4/2) moist; weak, subangular blocky structure; hard, friable, slightly sticky and plastic; slightly effervescent; clear, smooth boundary.
- Ap2—4 to 12 inches, grayish-brown (2.5Y 5/2) heavy loam, dark grayish brown (2.5Y 4/2) moist; weak, subangular blocky structure; hard, friable, slightly sticky and plastic; very few very fine roots; few very fine pores; slightly effervescent; clear, smooth boundary.
- C1—12 to 27 inches, light yellowish-brown (2.5Y 6/4) loam, light olive brown (2.5Y 5/4) moist; massive; hard, friable, slightly sticky and slightly plastic; few fine roots; common fine pores; strongly effervescent; gradual, wavy boundary.
- C2—27 to 33 inches, light brownish-gray (2.5Y 6/2) stratified silt loam and sandy loam, light olive brown (2.5Y 5/4) moist; massive; slightly hard, friable, nonsticky and slightly plastic; very few fine roots; strongly effervescent; gradual, wavy boundary.
- C3—33 to 60 inches, light yellowish-brown (2.5Y 6/4) light sandy loam, light olive brown (2.5Y 5/4) moist; few faint, reddish-brown mottles; massive; slightly hard, very friable, nonsticky and slightly plastic; slightly effervescent.

The A horizon is grayish-brown, light brownish-gray, and light yellowish-brown silty clay, silty clay loam, or loam. It ranges from 10YR to 2.5Y in hue. The C horizon is light yellowish brown, light brownish gray, and light olive gray.

**Haverson loam, 0 to 2 percent slopes (Hfa).**—This nearly level soil is on flood plains and low terraces. Most areas are nearly level and smooth, but in places there are scars of old stream channels. The soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of soils that are underlain by gravelly sand at a depth of 20 to 40 inches. These areas are indicated on the detailed soil map by a special symbol.

Runoff is slow, and the hazard of erosion is slight. Locally, spring flooding occurs in places. Streambank erosion is a concern of management along the perennial streams. This soil is suited to dryfarmed and irrigated crops, hay, wildlife, recreation, and range. Capability unit IIIc-1 dryland, IIc-1 irrigated; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Haverson loam, 2 to 4 percent slopes (Hfb).**—This gently sloping soil is on fans. Areas are 5 to 20 acres in size. Slopes are less than 200 feet long, and they are mostly 2 percent. The soil has a profile similar to the one described as representative of the series, but it is steeper. Included in mapping are small areas of McRae loam.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIIe-3 dryland, IIe-1 irrigated; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Haverson loam, saline (Hfc).**—This nearly level soil is on low terraces and flood plains, in swales, and below irrigation canals. Slopes are 0 to 2 percent. The soil has a profile similar to the one described as representative of the series, but visible salts are in the

upper 12 inches, a water table is at a depth of 36 inches, and brownish-yellow and yellow mottles are below a depth of 20 inches. Kochia and inland saltgrass are the common plants on this saline-affected soil. The salt horizons are typically 12 to 18 inches thick.

Included with this soil in mapping are spots of saline-affected Glenberg sandy loam. Steep areas are indicated on the detailed soil map by spot symbols.

Runoff is slow, and the hazard of erosion is slight. This soil needs drainage and leaching before crops will grow. Without reclamation, it is used for range, hay, recreation, and wildlife. If it is drained and leached of salts and if good management is used, the soil is suited to irrigated and dryfarmed crops. Capability unit IIIs-2 dryland; Saline Lowland range site, 10- to 14-inch precipitation zone; windbreak suitability group 2S.

**Haverson silty clay loam (Hfd).**—This nearly level soil is on terraces and fans. Slopes are 0 to 1 percent. Areas range from 5 to 40 acres in size. The soil has a profile similar to the one described as representative of the series, but it is silty clay loam to a depth of about 12 inches and has thin strata of silty clay loam and silty clay below a depth of 20 inches.

Runoff is slow, and the hazard of erosion is slight. This soil is suited to irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIIc-1 dryland, IIc-2 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Haverson silty clay (Hfe).**—This nearly level soil is on terraces and fans. It is in slack water areas and old meanders and swales where water is ponded for several days in spring. Slopes are 0 to 1 percent. Areas range from 3 to 10 acres in size. The soil has a profile similar to the one described as representative of the series, but the surface layer is silty clay 10 to 14 inches thick.

Runoff is slow, and the hazard of erosion is slight. In the swales and old meanders in places, a temporary water table is at a depth of 4 or 5 feet in spring and early in summer. This soil is suited to irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIIe-3 dryland, IIs-1 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Haverson silty clay, thick surface (Hff).**—This nearly level soil is on fans and terraces, typically at the lower ends of broad fans deposited on river terraces. Slopes are 0 to 2 percent. They range from 300 to 800 feet long. The soil has a profile similar to the one described as representative of the series, but the surface layer is silty clay 18 to 24 inches thick.

Runoff is slow, and the hazard of erosion is slight. The bare soil is subject to soil blowing. This soil is suited to irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIIe-3 dryland, IIs-1 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Haverson-Hysham silty clay loams (Hfh).**—This complex is made up of nearly level and gently sloping soils in stream valleys. It is 65 to 80 percent Haverson silty clay loam and 20 to 35 percent Hysham silty clay loam.



Slopes are 0 to 4 percent. Areas of the Hysham soil are 5 to 15 feet wide and are marked by surface crusting and greasewood. They typically have slopes of 1 percent, but they range to 4 percent. The Haverson and Hysham soils in this complex have profiles similar to those described as representative of their respective series, but the Haverson soil has a surface layer of silty clay loam, and the Hysham soil has a surface layer of silty clay.

Runoff is slow, and the hazard of erosion is moderate. In the large stream valleys, these soils are sometimes briefly flooded if the snow melts rapidly or after early summer rains. They are suited to range, recreation, and wildlife and to hay and dryfarmed crops. Capability unit IIIe-3 dryland; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 3S.

**Haverson and Glenberg soils (HGa).**—This undifferentiated soil group is made up of nearly level soils in river valleys. It consists of Haverson loam and silty clay loam and Glenberg fine sandy loam and loam in variable proportions. Slopes are 0 to 2 percent. The land surface is rough, and local relief is 1 foot to 3 feet. The Haverson and Glenberg soils in this mapping unit have profiles similar to the ones described as representative of their respective series, but some of the Haverson soils have a surface layer of silty clay loam, and some of the Glenberg soils have a surface layer of loam.

Included with these soils in mapping are areas of Riverwash and areas of soils that are similar to these Haverson and Glenberg soils but that are moderately deep over gravel. Proportion and extent of these included soils vary widely in areas of this mapping unit. Also included are areas of soils that have layers of gravelly sand at a depth of 20 to 40 inches.

Runoff is slow, and the hazard of erosion is severe. These soils are subject to overflow early in spring. The stream channel changes, and streambank erosion is active. The soils in old stream meanders have a water table at a depth of 3 to 5 feet. These soils are used for range, hay, wildlife, recreation, and pasture.

The principal tree species are cottonwood, aspen, willow, ash, and boxelder. The understory is wild rose, buffaloberry, snowberry, and western hawthorn. The stands are open and of mixed ages. Open grassy areas also occur. Areas suitable for irrigation require clearing and leveling. Capability unit IIIe-3 dryland; Sandy range site, 10- to 14-inch precipitation zone; windbreak suitability group 2W.

**Haverson and Lohmiller soils, channeled (HGb).**—This undifferentiated soil group is made up of nearly level to steep soils in stream-dissected valleys. It consists of Haverson loam and silty clay loam and Lohmiller silty clay loam. The proportion and extent of these soils vary widely, and no useful purpose would be served by mapping them separately. Channel erosion and the extreme stream meanders divide the mapped areas into 1/4- to 3-acre patches. Slopes are 0 to 4 percent on the valley bottom and 15 to 35 percent on the short terrace breaks, and the sides of the stream channels. The Haverson and Lohmiller soils in this mapping unit have profiles similar to the ones described as representative of their respective series, but they

are steeper, and in places the Haverson soil has a surface layer of silty clay loam. Included in mapping are spots of Hysham silty clay loam and Haverson soils, saline.

Runoff is slow, and the hazard of erosion is severe. Locally, runoff from tributaries flood some of these soils. The soils are suited to range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

**Haverson and Lohmiller soils, frequently flooded (HGC).**—This undifferentiated soil group is made up of nearly level and gently sloping soils in stream valleys. It consists of Haverson loam and silty clay loam and Lohmiller silty clay loam. The proportion and extent of these soils vary widely, and no useful purpose would be served by mapping them separately. Slopes are 0 to 4 percent. The Haverson soil in this mapping unit has a profile similar to the one described as representative of the Haverson series, but in places the surface layer is silty clay loam.

Runoff is slow, and the hazard of erosion is severe. These soils are subject to frequent flooding. They are overflowed when the snow melts rapidly or during early summer rain. They are suited to range, wildlife, and recreation. Capability unit VIw-1 dryland; Overflow range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

**Haverson and Lohmiller soils, wet (Hh).**—This undifferentiated soil group is made up of nearly level soils in perennial stream valleys. It consists of Haverson loam and silty clay loam and Lohmiller silty clay loam. The proportion and extent of these soils vary widely, and no useful purpose would be served by mapping them separately, because they have very limited use. Slopes are 0 to 2 percent. The Haverson and Lohmiller soils in this mapping unit have profiles similar to the ones described as representative of their respective series, but they are wet and contain visible salts.

Runoff is slow, and the hazard of erosion is slight. The water table fluctuates between depths of 36 and 60 inches. These soils are suited to range, wildlife, and recreation. Capability unit VIw-1 dryland; Saline Lowland range site, 10- to 14-inch precipitation zone; windbreak suitability group 3W.

**Haverson soils, saline (HK).**—This mapping unit is made up of nearly level soils on flood plains. It consists of Haverson silty clay loam and loam and some Lohmiller silty clay loam. Slopes are 0 to 2 percent. The soils in this mapping unit have profiles similar to the ones described as representative of their respective series, but visible salts are in the upper 12 inches, yellowish-brown mottles are below a depth of 30 inches, and in places the Haverson soil has a surface layer of silty clay loam. The native vegetation is mostly inland saltgrass and Kochia.

Runoff is slow, and the hazard of erosion is slight. The water table is at a depth of 3 feet or more during most of the growing season. These soils are suited to irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Drainage and the leaching of soluble salts are needed before crops can be grown. Capability unit IVs-2 dryland; Saline Lowland range site, 10- to



14-inch precipitation zone; windbreak suitability group 3S.

### Heldt Series

The Heldt series consists of deep, nearly level to strongly sloping, well-drained soils on fans, terraces, and foot slopes in the wide river and intermittent stream valleys. Slopes range from 0 to 15 percent. These soils formed in silty clay loam alluvium. Elevation ranges from 2,800 to 3,500 feet.

The native vegetation is mainly western wheatgrass, green needlegrass, big sagebrush, and blue grama. Annual precipitation is 12 to 14 inches, the average annual soil temperature is 47° to 49° F, and the frost-free period is 115 to 125 days.

In a representative profile the surface layer is grayish-brown silty clay loam about 4 inches thick. The subsoil is grayish-brown silty clay loam about 6 inches thick. The substratum is light yellowish-brown, light-gray, and light brownish-gray silty clay loam and clay loam that extends to a depth of 60 inches or more.

Permeability is slow, and available water capacity is high. The effective rooting depth is 60 inches or more. These soils are used for dryfarmed and irrigated crops, watershed, recreation, wildlife, and range.

Representative profile of Heldt silty clay loam, 4 to 8 percent slopes, in grassland, 450 feet west and 600 feet north of the SE. corner sec. 5, T. 1 S., R. 36 E.

- A—0 to 4 inches, grayish-brown (2.5Y 5/2) light silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak, fine, platy structure parting to weak, fine, granular; hard, friable, slightly sticky and plastic; slightly effervescent; clear, smooth boundary.
- B2—4 to 10 inches, grayish-brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak, medium, prismatic structure parting to moderate, medium, blocky; hard, friable, sticky and plastic; slightly effervescent; clear, wavy boundary.
- C1—10 to 15 inches, light yellowish-brown (2.5Y 6/4) silty clay loam, light olive brown (2.5Y 5/4) moist; weak, medium, prismatic structure parting to weak, coarse and medium, blocky; hard, friable, sticky and plastic; strongly effervescent; few lime threads; clear, wavy boundary.
- C2—15 to 23 inches, light yellowish-brown (2.5Y 6/4) silty clay loam, light olive brown (2.5Y 5/4) moist; weak, medium, blocky structure; hard, friable, sticky and plastic; strongly effervescent; common lime threads; gradual, wavy boundary.
- C3—23 to 44 inches, light-gray (2.5Y 7/2) silty clay loam, grayish brown (2.5Y 5/2) moist; massive; hard, friable, sticky and plastic; strongly effervescent; gradual boundary.
- C4—44 to 60 inches, light brownish-gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; massive; hard, friable, sticky and plastic; strongly effervescent.

The soil between depths of 10 and 40 inches is heavy silty clay loam or silty clay. Coarse fragments, shale, and gravel range from 0 to 5 percent throughout, and hue is 2.5Y to 5Y. The A horizon is light brownish gray, grayish brown, and olive gray. The Cca horizon is light gray and pale olive.

#### Heldt silty clay loam, 0 to 2 percent slopes (H1a).

—This soil is in small areas on terraces and fans. It has a profile similar to the one described as representative of the series, but it is less sloping.

Runoff is slow, and the hazard of erosion is slight. This soil is suited to most irrigated and dryfarmed

crops, hay, wildlife, recreation, and range. Capability unit IIIs-3 dryland, IIs-1 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

#### Heldt silty clay loam, 2 to 4 percent slopes (H1b).

—This soil is on long foot slopes and fans. Slopes range from 300 to 600 feet long. The soil has a profile similar to the one described as representative of the series, but it is less sloping and has a few pebbles on the surface in areas near gravel-capped hills.

Included with this soil in mapping are small areas of soils that have a substratum of clay or silty clay below a depth of 4 feet or dark-colored material below a depth of 30 inches. Also included are small spots of Lohmiller silty clay loam and McRae loam. These included soils make up as much as 25 percent of the total area of this mapping unit.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to most irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIIe-3 dryland, IIE-1 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

#### Heldt silty clay loam, 4 to 8 percent slopes (H1c).

—This soil is on foot slopes and fans and below areas of Shale outcrop. In places pebbles are scattered on the surface. Slopes are generally smooth, but deep gullies, 500 to 800 feet apart, occur in some areas. The soil has the profile described as representative of the series. Included in mapping are isolated 1- to 2-acre knobs of Midway silty clay loam and Lohmiller silty clay loam.

Runoff is rapid, and the hazard of erosion is moderate. This soil is suited to most irrigated and dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIIe-3 dryland, IIIe-1 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

#### Heldt silty clay loam, 8 to 15 percent slopes (H1d).

—This soil is in long, narrow areas on foot slopes along intermittent streams. Slopes are mostly 10 to 15 percent, and they range from 150 to 400 feet long. The soil has a profile similar to the one described as representative of the series, but it is steeper. Included in mapping is a band of Lohmiller silty clay loam below areas of Shale outcrop.

Runoff is rapid, and the hazard of erosion is severe. Most areas of this soil receive runoff from steeper soils above them. The soil is suited to dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IVE-3 dryland; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Heldt silty clay, 0 to 2 percent slopes (H1e).**—This soil is on large fans. Slopes are mostly 1 percent or less, and they range from 400 to 800 feet long. The soil has a profile similar to the one described as representative of the series, but the surface layer is silty clay 12 inches thick.

Runoff is slow, and the hazard of erosion is slight. This soil is suited to irrigated crops, recreation, wildlife, hay, and range. Capability unit IIs-1 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Heldt-Hysham silty clay loams, 0 to 2 percent slopes (H1f).**—This complex is made up of nearly level soils on



fans and low terraces and in intermittent stream valleys. It is about 70 percent Heldt silty clay loam and 25 percent Hysham silty clay loam. Slopes are mostly 0 to 1 percent. The Hysham soil is in the light-gray slickspots, which have a crusted surface and are nearly barren of vegetation.

Included with these soils in mapping are small areas of Hydro loam and Allentine silty clay that make up 5 to 10 percent of the area of this mapping unit.

Runoff is slow, and the hazard of erosion is slight. These soils are suited to range, hay, wildlife, recreation, and dryfarmed crops. Capability unit IIIe-3 dryland; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 3S.

**Heldt-Hysham silty clay loams, 2 to 4 percent slopes (Hlg).**—This soil is made up of gently sloping soils on fans and low terraces and in intermittent stream valleys. It is about 75 percent Heldt silty clay loam and 25 percent Hysham silty clay loam. Slopes are mostly 2 percent on the valley bottoms and 3 or 4 percent on the fans and valley sides. The Hysham soil is in spots about 15 feet wide where the vegetation is thin and the light-gray surface layer is crusted.

Runoff is medium, and the hazard of erosion is moderate. These soils are suited to range, hay, wildlife, recreation, and dryfarmed crops. Capability unit IIIe-3 dryland; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 3S.

## Hesper Series

The Hesper series consists of deep, nearly level to gently sloping, well-drained soils on terraces in the sedimentary uplands. Slopes range from 0 to 8 percent. These soils formed in calcareous, wind- and water-transported silt and very fine sand. Elevation ranges from 3,100 to 3,600 feet.

The native vegetation is mainly needleandthread, blue grama, big sagebrush, and western wheatgrass. Annual precipitation is 13 to 14 inches, the average annual soil temperature is 47° to 49° F, and the frost-free period is 110 to 120 days.

In a representative profile the surface layer is light brownish-gray silty clay loam about 6 inches thick. The subsoil is brown and light olive-brown silty clay about 16 inches thick. The substratum is light brownish-gray silty clay loam to a depth of about 49 inches. Very gravelly sand extends to a depth of 60 inches or more.

Permeability is moderately slow, and available water capacity is moderate. The effective rooting depth is 50 inches or more. These soils are used for dryfarmed crops, wildlife, recreation, watershed, and range. They are suitable for irrigation.

Representative profile of Hesper silty clay loam, 0 to 1 percent slopes, in hayland, 1,320 feet south and 330 feet west of the NE. corner sec. 32, T. 2 N., R. 33 E.

Ap1—0 to 2 inches, light brownish-gray (10YR 6/2) light silty clay loam, dark grayish brown (10YR 4/2) moist; moderate, thin, platy structure; hard, friable, sticky and plastic; few very fine roots; common clear sand grains on the tops of the structure plates; clear, smooth boundary.

Ap2—2 to 6 inches, light brownish-gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak, coarse, blocky structure; hard, friable, sticky

and plastic; common very fine roots; many very fine pores; common clean sand grains coating peds; clear, smooth boundary.

B2t—6 to 14 inches, brown (10YR 5/3) silty clay, dark brown (10YR 3/3) moist; moderate, medium, prismatic structure parting to strong, medium and fine, blocky; very hard, firm, very sticky and very plastic; common fine roots; many very fine pores; moderately thick, patchy clay films on peds; clear, wavy boundary.

B3—14 to 22 inches, light olive-brown (2.5Y 5/4) silty clay, olive brown (2.5Y 4/4) moist; moderate, medium, prismatic structure parting to strong, fine and medium, blocky; very hard, firm, very sticky and very plastic; common very fine roots; common very fine pores; slightly effervescent; gradual, wavy boundary.

C1ca—22 to 34 inches, light brownish-gray (2.5Y 6/2) heavy silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak, coarse, prismatic structure parting to moderate, medium, blocky; very hard, firm, very sticky and very plastic; few fine roots; many very fine pores; strongly effervescent; common fine lime threads; gradual, wavy boundary.

C2ca—34 to 49 inches, light brownish-gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; weak, coarse, blocky structure; very hard, friable, sticky and plastic; strongly effervescent; few fine, soft lime masses and common fine lime threads.

IIC—49 to 60 inches, very gravelly sand.

Hue is 10YR to 2.5Y throughout. The A horizon is light brownish gray, grayish brown, or pale brown. The B2t horizon is dark brown and brown. It is 35 to 50 percent clay. The Cca horizon is light gray and light brownish gray. Very gravelly sand is below a depth of 40 inches.

### Hesper silty clay loam, 0 to 1 percent slopes (Hma).

—This soil is on high terraces and benches. A few pebbles are scattered on the surface near shallow drainageways. The soil has the profile described as representative of the series. Included in mapping are small areas of Bew silty clay loam and Keiser silty clay loam.

Runoff is slow, and the hazard of erosion is slight. This soil is suited to irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIIc-1 dryland, IIC-2 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

### Hesper silty clay loam, 1 to 4 percent slopes (Hmb).

—This soil is on high terraces and fans. It has a profile similar to the one described as representative of the series, but it is steeper. Included in mapping are spots of Keiser silty clay loam.

Runoff is slow, and the hazard of erosion is moderate. This soil is suited to irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIIe-3 dryland, IIC-1 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

### Hesper silty clay loam, 4 to 8 percent slopes (Hmc).

—This soil is on high terraces and fans. Slopes are short and range from 6 to 8 percent on the terraces. They are long and smooth and are 4 or 5 percent on the fans. The soil has a profile similar to the one described as representative of the series, but it is steeper. Included in mapping are spots of Keiser silty clay loam.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to irrigated and dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIIe-3 dryland, IIIe-1 irrigated; Clayey

range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

## Hydro Series

The Hydro series consists of deep, nearly level to gently sloping well-drained soils on terraces, fans, and benches. Slopes range from 0 to 8 percent. These soils formed in clay loam and silty clay loam alluvium that contains a moderate amount of sodium. Elevation ranges from 3,000 to 3,800 feet.

The native vegetation is mainly western wheatgrass, blue grama, Sandberg bluegrass, big sagebrush, and plains reedgrass. Annual precipitation is 13 to 15 inches, the average annual soil temperature is 47° to 49° F, and the frost-free period is 110 to 120 days.

In a representative profile the surface layer is light brownish-gray very fine sandy loam about 2 inches thick. The subsurface layer is brown loam about 3 inches thick. The subsoil is brown, grayish-brown, and light brownish-gray silty clay and silty clay loam about 22 inches thick. The substratum is light brownish-gray, olive-gray, and light olive-gray silty clay loam, silty clay, silt loam, and very fine sandy loam that extends to a depth of 65 inches or more.

Permeability is slow, and available water capacity is moderate or high. The effective rooting depth is 60 inches or more. These soils are used for dryfarmed crops, wildlife, recreation, watershed, and range. They are suitable for irrigation.

Representative profile of Hydro loam, 0 to 8 percent slopes, in grassland, 1,320 feet south and 1,980 feet east of the NW. corner sec. 13, T. 1 N., R. 35 E.

A2—0 to 2 inches, light brownish-gray (10YR 6/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate, thin, platy structure; slightly hard, very friable, nonsticky and slightly plastic; abundant clean sand grains; clear, smooth boundary.

A&B—2 to 5 inches, brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak, medium, prismatic structure parting to moderate, thin, platy; slightly hard, friable, slightly sticky and slightly plastic; clean sand grains coating the tops of the plates; clear, smooth boundary.

B&A—5 to 7 inches, brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) moist; moderate, medium, prismatic structure breaking to moderate, medium, platy; hard, friable, sticky and plastic; clean sand grains coating the tops of the plates; thin, patchy clay films on peds; clear, wavy boundary.

B21t—7 to 12 inches, grayish-brown (2.5Y 4/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate, medium, prismatic structure parting to strong, fine and medium, blocky; very hard, firm, very sticky and very plastic; moderately thick, patchy clay films on peds; clear, wavy boundary.

B22t—12 to 15 inches, grayish-brown (2.5Y 5/2) silty clay, olive brown (2.5Y 4/4) moist; moderate, medium, prismatic structure parting to strong, fine, blocky; very hard, firm, very sticky and very plastic; moderately thick, patchy clay films on peds; clear, wavy boundary.

B23t—15 to 21 inches, grayish-brown (2.5Y 5/2) silty clay, olive brown (2.5Y 4/4) moist; moderate, medium, prismatic structure parting to strong, fine, blocky; very hard, firm, very sticky and very plastic; moderately thick, patchy clay films on peds; slightly effervescent; clear, wavy boundary.

B3ca—21 to 27 inches, light brownish-gray (2.5Y 6/2) silty clay, light olive brown (2.5Y 5/4) moist; moder-

ate, medium, prismatic structure parting to moderate, fine, blocky; very hard, firm, very sticky and very plastic; strongly effervescent; few fine lime mottles; gradual, wavy boundary.

C1ca—27 to 32 inches, light brownish-gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; weak, medium, blocky structure; very hard, firm, very sticky and very plastic; strongly effervescent; few medium lime mottles; gradual, wavy boundary.

C2—32 to 39 inches, olive-gray (5Y 5/2) silty clay loam, olive (5Y 4/3) moist; massive; very hard, firm, sticky and plastic; strongly effervescent; gradual boundary.

IIC—39 to 65 inches, light olive-gray (5Y 6/2) stratified silt loam and very fine sandy loam, olive gray (5Y 4/2) moist; soft, friable, slightly sticky and slightly plastic; strongly effervescent.

Hue ranges from 7.5YR to 2.5Y throughout. The non-calcareous part of the solum ranges from 12 to 18 inches in thickness. The A2 horizon is grayish-brown to light-gray very fine sandy loam to silt loam. The content of clay in the B2t horizon ranges from 45 to 55 percent. This horizon is dark brown and brown. The Cca horizon is light olive brown and light olive gray.

**Hydro loam, 0 to 8 percent slopes (Hna).**—This nearly level to gently sloping soil is in 5- to 35-acre areas on fans, foot slopes, and terraces. Slopes range from 300 to 600 feet long. Slopes are 0 to 2 percent on the terraces, 2 to 5 percent on the fans, and 5 to 8 percent on the foot slopes. The soil has the profile described as representative of the series. Included in mapping are small areas of Allentine silty clay.

Runoff is slow to medium, and the hazard of erosion is slight to moderate. This soil is suited to dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIc-1 dryland; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 2S.

**Hydro silt loam, 0 to 2 percent slopes (Hnb).**—This nearly level soil is on terraces, fans, and loess-mantled hills. Areas range from 5 to 20 acres in size. The soil has a profile similar to the one described as representative of the series, but the surface layer is grayish-brown silt loam. Included in mapping are small areas of Allentine silty clay.

Runoff is slow, and the hazard of erosion is slight. This soil is suited to dryfarmed and irrigated crops, hay, wildlife, recreation, and range. Capability unit IIc-1 dryland, IIs-1 irrigated; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 2S.

**Hydro silt loam, 2 to 4 percent slopes (Hnc).**—This gently sloping soil is on fans and loess-mantled hills. The soil has a profile similar to the one described as representative of the series, but the surface layer is grayish-brown silt loam. Included in mapping are areas of Richfield silty clay loam.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIe-2 dryland, IIs-1 irrigated; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 2S.

**Hydro silt loam, 4 to 8 percent slopes (Hnd).**—This gently sloping soil is in small areas on fans, terraces, and loess-mantled hills. The soil has a profile similar to the one described as representative of the series, but



the surface layer is grayish-brown silt loam. Included in mapping are spots of Richfield and Beauvais soils.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to dryfarmed crops, wildlife, recreation, watershed, and range. Capability unit IIIe-2 dryland; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 2S.

**Hydro silty clay loam, 0 to 2 percent slopes (Hne).**—This nearly level soil is on loess-mantled, high gravelly terraces and benches. Most areas are cultivated, and the uniform light brownish-gray dry surface color is broken only by grayish-brown spots of included Gilt Edge and Bew soils. The soil has a profile similar to the one described as representative of the series, but the surface layer is silty clay loam that is underlain by gravelly loam and sand at a depth of 50 to 60 inches. Included in mapping is Shonkin silt loam in small depressions.

Runoff is slow, and the hazard of erosion is slight. This soil is suited to irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIIs-3 dryland, IIs-1 irrigated; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 2S.

**Hydro silty clay loam, 2 to 4 percent slopes (Hnf).**—This gently sloping soil is on foot slopes, fans, and wide, sloping ridges. The soil has a profile similar to the one described as representative of the series, but the surface layer is silty clay loam and in places shale bedrock is in the substratum above a depth of 40 inches. Locally, the soil has the reddish-gray and dark-red color of the soils on the burned shale hills. Included in mapping are small areas of Allentine soils.

Runoff is medium, and the hazard of erosion is slight. This soil is suited to dryfarmed and irrigated crops, hay, wildlife, recreation, and range. Capability unit IIIe-3 dryland, Iie-1 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 2S.

**Hydro-Allentine complex, 1 to 4 percent slopes (Hng).**—This complex is made up of nearly level and gently sloping soils on fans and terraces. It is 60 to 80 percent Hydro loam and 20 to 40 percent Allentine silty clay. The Allentine soil has a thin cover of grass or, in plowed fields has a cover of hard clods. Where the soils have not been plowed, the Allentine soil is in microdepressions. Included in mapping are a few spots of Bone clay.

Runoff is slow, and the hazard of erosion is slight. These soils are suited to wildlife, recreation, range, and hay. They are also suited to dryfarmed crops in areas that are not more than 20 percent Allentine soil. Capability unit IVs-2 dryland; Pan Spots range site, 10- to 14-inch precipitation zone; windbreak suitability group 3S.

**Hydro-Allentine complex, 4 to 8 percent slopes (Hnh).**—This complex is made up of sloping soils on fans and terraces. It is about 75 percent Hydro loam and 25 percent Allentine clay loam. The Allentine soil has a thin cover of grass and is in microdepressions. In cultivated fields the Allentine soil has hard surface clods.

Runoff is medium, and the hazard of erosion is moderate. These soils are suited to dryfarmed crops, hay,

wildlife, recreation, watershed, and range. Most cultivated areas need protection against runoff from soils above them. Capability unit IVs-2 dryland; Pan Spots range site, 10- to 14-inch precipitation zone; windbreak suitability group 3S.

**Hydro-Gilt Edge complex, 0 to 1 percent slopes (Hnk).**—This complex is made up of nearly level soils on loess-mantled gravelly terraces. It is about 40 percent Hydro loam, 40 percent Gilt Edge silty clay loam, and 20 percent Keiser silty clay loam, Shonkin loam, and Bew silty clay loam. In cultivated areas the contrasting colors of the dry soils helps to identify them. The light brownish-gray Hydro soil is level and has slow surface runoff. The grayish-brown Gilt Edge soil is on the higher parts of the landscape. The light-gray Shonkin soil is in shallow depressions. The Hydro and Gilt Edge soils in this complex have profiles similar to those described as representative of their respective series, but a few pebbles are on the surface.

Runoff water usually floods the Shonkin soil early in spring. Runoff is slow, and the hazard of erosion is slight. Nearly all of this complex is used for dryfarmed crops. These soils are also suited to range, wildlife, and recreation. Capability unit IIIs-3 dryland; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 2S.

## Hysham Series

The Hysham series consists of deep, nearly level to strongly sloping, well-drained, sodium-affected soils on terraces, fans, and foot slopes. Slopes range from 0 to 15 percent. These soils formed in mixed loam, silt loam, and silty clay loam alluvium. Elevation ranges from 2,850 to 3,600 feet.

The native vegetation is mainly plains pricklypear, greasewood, silver sagebrush, western wheatgrass, and Sandberg bluegrass. Annual precipitation is 13 to 14 inches, the average annual soil temperature is 47° to 50° F, and the frost-free period is 115 to 125 days.

In a representative profile the surface layer is grayish-brown silt loam about 1 inch thick. The underlying material is grayish-brown and light olive-brown silty clay loam that extends to a depth of 63 inches or more.

Permeability is slow, and available water capacity is high. The effective rooting depth is 60 inches or more. These soils are used for wildlife, recreation, watershed, range, and irrigated crops.

Representative profile of Hysham silty clay loam, 4 to 8 percent slopes, in grassland, 100 feet east and 75 feet south of the center of sec. 9, T. 1 S., R. 32 E.

A—0 to 1 inch, grayish-brown (2.5Y 5/2) heavy silt loam, very dark grayish brown (2.5Y 3/2) moist; moderate, thin, platy structure; slightly hard, friable, slightly sticky and plastic; slightly effervescent; clear boundary.

C1—1 inch to 7 inches, grayish-brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate, subangular blocky structure; hard, firm, sticky and plastic; strongly effervescent; gradual boundary.

C2—7 to 11 inches, grayish-brown (2.5Y 5/2) heavy silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate, medium, subangular blocky structure;

- very hard, firm, sticky and very plastic; strongly effervescent; gradual, wavy boundary.
- C3—11 to 14 inches, grayish-brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak, fine, subangular blocky structure; hard, friable, slightly sticky and plastic; strongly effervescent; few fine salt threads and crystals; gradual, wavy boundary.
- C4—14 to 23 inches, grayish-brown (2.5Y 5/2) heavy silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak, fine, subangular blocky structure; very hard, firm, sticky and plastic; strongly effervescent; common fine salt crystals; gradual, wavy boundary.
- C5—23 to 43 inches, grayish-brown (2.5Y 5/2) heavy silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak, fine, subangular blocky structure parting to weak, medium, platy; very hard, firm, sticky and plastic; strongly effervescent; common fine salt crystals; gradual boundary.
- C6—43 to 63 inches, light olive-brown (2.5Y 5/4) silty clay loam, olive brown (2.5Y 4/4) moist; massive; hard, friable, sticky and plastic; strongly effervescent; few fine salt crystals.

Hue ranges from 2.5Y to 5Y throughout. The soil between depths of 10 and 40 inches is loam, clay loam, or silty clay loam. The Ap horizon ranges from grayish brown to olive gray. The C horizon is grayish brown, light yellowish brown, light olive brown, and pale olive.

**Hysham loam, 0 to 2 percent slopes (Ho).**—This soil is on terraces and fans. It has a profile similar to the one described as representative of the series, but it is steeper and has a surface layer of loam.

Included with this soil in mapping are spots of Haverson loam that make up as much as 25 percent of the area of this mapping unit. Also included are areas of soils that are similar to this Hysham soil but that have a water table below a depth of 3 feet during part of the growing season.

Runoff is slow, and the hazard of erosion is slight. This soil is suited to wildlife, recreation, and range. After reclamation by drainage and leaching, it is suited to alkali-tolerant crops. Capability unit VIs-1 dryland; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 3S.

**Hysham silty clay loam, 4 to 8 percent slopes (Hp).**—This soil is on foot slopes and fans and in intermittent stream valleys. It has the profile described as representative of the series. Included in mapping are spots of Lohmiller silty clay loam.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 3S.

**Hysham silty clay loam, channeled, 0 to 4 percent slopes (Hr).**—This soil is in long, narrow areas of intermittent streams. The areas are strongly dissected by shallow to deep channels. Slopes are mostly less than 1 percent, but they range to 3 or 4 percent. The soil has a profile similar to the one described as representative of the series, but the substratum in places has strata of clay loam and silty clay.

Runoff is slow, and the hazard of erosion is moderate. Some flooding occurs where the stream channel is less than 5 feet deep. This soil is suited to range, wildlife, and recreation. Capability unit VIs-1 dryland; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 3S.

**Hysham-Midway silty clay loams, 4 to 15 percent slopes (HS).**—This complex is made up of gently sloping and strongly sloping soils in wide, intermittent stream valleys. It is about 60 percent Hysham silty clay loam, 25 percent Midway silty clay loam, and 15 percent eroded edges and bottoms of the stream channels. The soils are in the bottoms and on the sides of valleys below the bordering shale and gravel hills. Hysham silty clay loam is in the valleys and on the lower valley sides between ridges and knolls of Midway silty clay loam. The Midway soil has slopes of mostly 12 to 15 percent. Included in mapping are small areas of Havre loam.

Runoff is medium, and the hazard of erosion is moderate. These soils are used for range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 3S.

**Hysham and Lohmiller silty clay loams, 0 to 8 percent slopes (HT).**—This association is in intermittent stream valleys on narrow terraces and small fans. It consists of Hysham silty clay loam and Lohmiller silty clay loam, and the amount of each soil varies widely. Meandering channels have cut the soils into ½- to 5-acre, irregularly shaped areas. The Hysham soil has a crusted surface and a cover of greasewood. The Hysham and Lohmiller soils in this association have profiles similar to the ones described as representative of their respective series, but the Hysham soil is less sloping and the Lohmiller soil is steeper.

Runoff is slow, and the hazard of erosion is moderate. These soils are suited to range and wildlife. Capability unit VIe-1 dryland; Overflow range site, 10- to 14-inch precipitation zone; windbreak suitability group 3S.

## Judith Series

The Judith series consists of deep, nearly level to steep and gently undulating to hilly, well-drained soils on high terraces and fans. Slopes range from 0 to 35 percent. These soils formed in calcareous loam and clay loam alluvium over thick beds of loam-filled gravel. Elevation ranges from 3,600 to 4,500 feet.

The native vegetation is mainly green needlegrass, Sandberg bluegrass, silver sagebrush, coneflower, white loco, and prairie junegrass. Annual precipitation is 14 to 17 inches, the average annual soil temperature is 45° to 47° F, and the frost-free period is 90 to 115 days.

In a representative profile the surface layer is dark grayish-brown clay loam about 2 inches thick. The subsoil is grayish-brown clay loam about 6 inches thick. The substratum is pale-brown, light-gray, and white loam and gravelly loam that grades to very gravelly loam below a depth of 30 inches and that extends to a depth of 54 inches or more.

Permeability and available water capacity are moderate. The effective rooting depth is 40 inches or more. These soils are used for dryfarmed and irrigated crops, wildlife, recreation, watershed, and range.

Representative profile of Judith clay loam, 0 to 2 percent slopes, in grassland, 990 feet west of the center of sec. 13, T. 5 S., R. 28 E.



- A1—0 to 2 inches, dark grayish-brown (10YR 4/2) light clay loam, very dark grayish brown (10YR 3/2) moist; moderate, thin, platy structure; hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; clear, smooth boundary.
- B2—2 to 8 inches, grayish-brown (10YR 5/2) light clay loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, prismatic structure parting to moderate, fine, blocky; hard, firm, sticky and plastic; common micro roots; few very fine pores; clear, wavy boundary.
- C1—8 to 12 inches, pale-brown (10YR 6/3) loam, brown (10YR 5/3) moist; moderate, weak, prismatic structure parting to weak, medium and fine, blocky; hard, friable, sticky and plastic; common very fine roots; common very fine pores; strongly effervescent; few fine, soft lime masses; gradual, wavy boundary.
- C2ca—12 to 17 inches, light-gray (10YR 7/2) heavy loam, light brownish gray (10YR 6/2) moist; moderate, fine and medium, blocky structure; hard, friable, sticky and plastic; common very fine roots; common very fine pores; strongly effervescent; common fine, soft lime masses; gradual, wavy boundary.
- C3ca—17 to 25 inches, white (10YR 8/2) heavy loam, very pale brown (10YR 7/3) moist; massive; hard, friable, slightly sticky and plastic; few very fine roots; common very fine pores; violently effervescent; diffuse, wavy boundary.
- C4ca—25 to 31 inches, white (10YR 8/2) gravelly loam, pale brown (10YR 6/3) moist; massive; hard, friable, slightly sticky and plastic; violently effervescent; 25 percent (volume) fragments of pebble size; thin lime casts on pebbles; diffuse, wavy boundary.
- C5—31 to 54 inches, light-gray (10YR 7/2) very gravelly loam, grayish brown (10YR 5/2) moist; loose, friable, sticky and plastic; strongly effervescent; 60 percent (volume) fragments of pebble size; lime casts on pebbles.

Hue ranges from 10YR to 7.5YR throughout. The soil between depths of 10 and 40 inches, on a weighted average, is 20 to 35 percent clay and 15 to 30 percent limestone and quartzite fragments of pebble size. The A horizon is dark grayish brown, grayish brown, and brown. The Cca horizon is white, light gray, light brownish gray, pink, very pale brown, and pale yellow. It has a 15- to 35-percent calcium carbonate equivalent.

**Judith clay loam, 0 to 2 percent slopes (Jc).**—This nearly level soil is on gravel benches and terraces. Slopes are mostly less than 1 percent. The soil has the profile described as representative of the series. Included in mapping are areas of soils that have a gravelly substratum at a depth of 36 inches.

Runoff is slow, and the hazard of erosion is slight. This soil is used for irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIs-2 dryland, IIC-1 irrigated; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 2L.

**Judith clay loam, 2 to 4 percent slopes (Jd).**—This gently sloping soil is on gravel benches and terraces. It has a profile similar to the one described as representative of the series, but it is steeper. Included in mapping are small knobs and narrow ridges of Windham gravelly loam.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIE-2 dryland, IIE-1 irrigated; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 2L.

**Judith clay loam, 4 to 8 percent slopes (Je).**—This gently sloping soil is on high gravel benches. Slopes are mostly 6 to 8 percent, and they range from 50 to 250 feet long. The soil has a profile similar to the one described as representative of the series, but it is steeper. Included in mapping are spots of Windham gravelly loam.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to irrigated and dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIIe-2 dryland, IIIe-1 irrigated; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 2L.

**Judith-Windham complex, 4 to 8 percent slopes (Jh).**—This complex is made up of gently sloping soils on gravel-capped benches. It is about 65 percent Judith clay loam and 35 percent Windham gravelly and cobbly loam. The Judith soil is on gravel-free areas between shallow drainageways. The Windham soils are on the edges of benches, along drainageways, and in areas where surface pebbles and cobbles are numerous. The Judith and Windham soils in this complex have profiles similar to the ones described as representative of their respective series, but they are steeper. In cultivated fields the Windham soils are light gray. Included in mapping are small areas of Savage silty clay loam.

Runoff is medium, and the hazard of erosion is moderate. These soils are suited to dryfarmed crops, hay, wildlife, recreation, watershed, and range. The surface cobbles and low crop yields on the Windham soils are a concern of management if the soils are cultivated. Capability unit IIIe-2 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 3L.

**Judith-Windham complex, 8 to 15 percent slopes (Jk).**—This complex is made up of strongly sloping soils on fans and benches. It is 40 to 60 percent Judith cobbly silt loam and 25 to 40 percent Windham cobbly loam. The Judith soil is on smooth, convex slopes. The Windham soil is in bands along benches, fans, and deep drainageways and on sharp, narrow ridges between drainageways. Coarse fragments of gravel and cobble size cover 10 to 15 percent of the Judith soil and 10 to 20 percent of the Windham soil. The Judith and Windham soils in this complex have profiles similar to the ones described as representative of their respective series, but the Judith soil has a surface layer of cobbly silt loam, and the Windham soil, of cobbly loam. Included in mapping are small spots of Danvers silty clay loam.

Runoff is rapid, and the hazard of erosion is moderate. These soils are suited to wildlife, recreation, watershed, range, hay, and dryfarmed crops. Capability unit IVE-2 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 3L.

## Keiser Series

The Keiser series consists of deep, nearly level to gently sloping and undulating, well-drained soils on high terraces, benches, and fans. Slopes range from 0 to 8 percent. These soils formed in calcareous al-



luvium and wind-deposited silt. Elevation ranges from 3,000 to 3,600 feet.

The native vegetation is mainly needleandthread, big sagebrush, western wheatgrass, and blue grama. Annual precipitation is 13 to 14 inches, the average annual soil temperature is 47° to 49° F, and the frost-free period is 115 to 125 days.

In a representative profile the surface layer is light brownish-gray loam about 1 inch thick. The subsoil is brown, dark-brown, light yellowish-brown, and light brownish-gray loam and silty clay loam about 20 inches thick. The substratum is light brownish-gray and grayish-brown silt loam that extends to a depth of 60 inches or more.

Permeability is moderately slow, and available water capacity is high. The effective rooting depth is 60 inches or more. These soils are used for dryfarmed and irrigated crops, wildlife, recreation, watershed, and range.

Representative profile of Keiser silty clay loam, 2 to 4 percent slopes, in grassland, 660 feet south and 600 feet west of the center of sec. 16, T. 1 S., R. 33 E.

- A—0 to 1 inch, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak, coarse, platy structure parting to weak, medium, granular; slightly hard, very friable, nonsticky and slightly plastic; abrupt, smooth boundary.
- B1—1 inch to 3 inches, brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate, medium, platy structure; slightly hard, friable, slightly sticky and slightly plastic; clear, smooth boundary.
- B21t—3 to 7 inches, dark-brown (10YR 4/3) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, prismatic structure parting to strong, fine and medium, blocky; hard, firm, sticky and very plastic; common medium and fine pores; moderately thick, patchy clay films on peds; clear, wavy boundary.
- B22t—7 to 10 inches, light yellowish-brown (2.5Y 6/4) silty clay loam, light olive brown (2.5Y 5/4) moist; moderate, medium, prismatic structure parting to moderate, medium, blocky; hard, friable, sticky and plastic; thin, patchy clay films on peds; slightly effervescent; clear, wavy boundary.
- B3ca—10 to 21 inches, light brownish-gray (2.5Y 6/2) silty clay loam, light olive brown (2.5Y 5/4) moist; moderate, coarse, prismatic structure parting to moderate, coarse, blocky; hard, friable, slightly sticky and plastic; strongly effervescent; common medium lime masses; gradual boundary.
- C1ca—21 to 26 inches, light brownish-gray (2.5Y 6/2) silt loam, light olive brown (2.5Y 5/4) moist; weak, coarse, blocky structure; hard, friable, slightly sticky and slightly plastic; strongly effervescent; gradual boundary.
- C2—26 to 39 inches, light brownish-gray (2.5Y 6/2) silt loam, olive brown (2.5Y 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; strongly effervescent; gradual boundary.
- C3—39 to 60 inches, grayish-brown (2.5Y 5/2) coarse silt loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; slightly effervescent.

Depth to calcareous material ranges from 7 to 10 inches. Hue is 10YR to 2.5Y throughout. The soil is 0 to 5 percent coarse fragments throughout. The B2t horizon is brown, light yellowish brown, light olive brown, and dark grayish brown. The Cca horizon is pale brown, light brownish gray, light olive brown, olive brown, and light yellowish brown. It has a calcium carbonate equivalent of 7 to 15 percent.

**Keiser silty clay loam, 0 to 2 percent slopes (Kc).**

—This nearly level soil is on terraces, fans, and silt-mantled hills. Areas are 20 to 60 acres in size. The soil has a profile similar to the one described as representative of the series, but it is less sloping.

Included with this soil in mapping are small areas of Shonkin loam and Hesper silty clay loam. Also included, along deep drainageways that cut through the terrace edge, is a band, 100 to 300 feet wide, of soils that are underlain by gravelly sand at a depth of 20 to 36 inches.

Runoff is slow, and the hazard of erosion is slight. This soil is suited to dryfarmed and irrigated crops, hay, wildlife, recreation, and range. Capability unit IIc-1 dryland, IIc-1 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Keiser silty clay loam, 2 to 4 percent slopes (Kd).**

—This gently sloping soil is on terraces, fans, and silt-mantled hills. Slopes are mostly 2 percent, but they are 3 or 4 percent in shallow drainageways. The soil has the profile described as representative of the series. Included in mapping are areas of Shonkin loam in shallow swales and depressions.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIIe-3 dryland, IIe-1 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Keiser silty clay loam, 4 to 8 percent slopes (Ke).**

—This gently sloping soil is on foot slopes, fans, and eroded terrace edges. The areas on foot slopes and fans are smooth and have only shallow drainageways. The terrace edges are deeply dissected by many drainageways. The soil has a profile similar to the one described as representative of the series, but it is steeper.

Included with this soil in mapping are small areas where the surface layer is clay loam or gravelly loam and areas where the substratum is violently effervescent.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to irrigated and dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIIe-3 dryland, IIIe-1 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Keiser-Colby complex, gently undulating (Kf).**—This complex is made up of gently undulating soils on gravel terraces. It is 45 to 60 percent Keiser silty clay loam, 25 to 40 percent Colby loam, and 10 to 20 percent Bone clay loam. Slopes are 1 to 4 percent. The Keiser soil has smooth slopes, and the Colby soil is on narrow ridgetops and on the sides of shallow drainageways. The Bone soil is in and around barren pan-spots where surface drainage is slow. In plowed fields the Colby soil is lighter colored than the Keiser soil, and the Bone soil has a cloddy surface.

Runoff is slow, and the hazard of erosion is slight. These soils are suited to dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIIe-3 dryland; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.



## Kim Series

The Kim series consists of deep, gently sloping and strongly sloping, well-drained soils on terraces and fans. Slopes range from 4 to 15 percent. These soils formed in calcareous, mixed loam, silt loam, and fine sandy loam alluvium. Elevation ranges from 2,900 to 3,500 feet.

The native vegetation is mainly bluebunch wheatgrass, big sagebrush, blue grama, and broom snakeweed. Annual precipitation is 13 to 14 inches, the average annual soil temperature is 48° to 50° F, and the frost-free period is 115 to 125 days.

In a representative profile the surface layer is grayish-brown loam about 4 inches thick. The underlying material is light brownish-gray and light yellowish-brown loam and silt loam that extends to a depth of 65 inches or more.

Permeability is moderate, and available water capacity is high. The effective rooting depth is 60 inches or more. These soils are used for range, wildlife, recreation, watershed, and dryfarmed crops.

Representative profile of Kim loam, 4 to 15 percent slopes, in grassland, 1,020 feet north and 100 feet east of the SW. corner sec. 12, T. 1 N., R. 30 E.

- A1—0 to 4 inches, grayish-brown (2.5Y 5/2) loam, very dark grayish brown (2.5Y 3/2) moist; weak, very thin, platy structure; soft, friable slightly sticky and slightly plastic; common fine roots; slightly effervescent; clear, wavy boundary.
- C1—4 to 13 inches, light brownish-gray (2.5Y 6/2) heavy loam, olive brown (2.5Y 4/4) moist; hard, friable, sticky and plastic; common very fine roots; common fine pores; strongly effervescent; few indistinct, soft lime masses; gradual, wavy boundary.
- C2—13 to 23 inches, light yellowish-brown (2.5Y 6/4) heavy loam, olive brown (2.5Y 4/4) moist; weak, very coarse, prismatic structure; hard, friable, sticky and slightly plastic; common fine roots; common very fine pores; strongly effervescent; few indistinct, soft lime masses; gradual, wavy boundary.
- C3—23 to 33 inches, light brownish-gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; weak, coarse, blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; common very fine pores; strongly effervescent; few fine, soft lime masses; diffuse boundary.
- C4—33 to 65 inches, light brownish-gray (2.5Y 6/2) silt loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine pores; strongly effervescent.

The soil between depths of 10 and 40 inches is typically loam, coarse silt loam, or light clay loam. Hue ranges from 7.5YR to 5Y throughout. The A horizon is grayish brown and olive gray. The C horizon ranges from light yellowish brown to pale olive.

**Kim loam, 4 to 15 percent slopes (Kg).**—This soil is on the eroding edges of fans, terraces, and foot slopes. Areas are long, narrow, and irregularly shaped. They follow the contours of gullies and coulees that dissect the fans and terraces. Included in mapping are areas of eroded soils that have lost their original surface layer.

Runoff is rapid, and the hazard of erosion is severe. This soil is suited to watershed, recreation, wildlife, hay, pasture, and range. All areas receive runoff from soils above them. Capability unit IVE-3 dryland; Silty range site, 10- to 14-inch precipitation zone; wind-break suitability group 1.

## Korchea Series

The Korchea series consists of deep, nearly level to steep, well-drained soils on flood plains and low terraces and fans. Slopes range from 0 to 35 percent. These soils formed in stratified, calcareous loam, silt loam, and sandy loam alluvium. Elevation ranges from 3,300 to 4,300 feet.

The native vegetation is mainly western wheatgrass, Sandberg bluegrass, silver sagebrush, and basin wild-rye. Annual precipitation is 14 to 17 inches, the average annual soil temperature is 45° to 47° F, and the frost-free period is 105 to 115 days.

In a representative profile the surface layer is grayish-brown loam about 9 inches thick. The underlying material is light brownish-gray and light yellowish-brown loam, silt loam, and loamy sand that extends to a depth of 72 inches or more.

Permeability is moderate, and available water capacity is high. The effective rooting depth is 60 inches or more. These soils are used for irrigated and dry-farmed crops, wildlife, recreation, watershed, and range.

Representative profile of Korchea loam, 0 to 2 percent slopes, in abandoned cropland, 850 feet south and 2,240 feet east of the NE. corner sec. 4, T. 5 S., R. 35 E.

- Ap—0 to 9 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; slightly effervescent; abrupt, smooth boundary.
- C1—9 to 18 inches, light brownish-gray (10YR 6/2) loam that has several 1- to 2-inch bands of loamy sand, dark grayish brown (10YR 4/2) moist; weak, coarse, prismatic structure; hard, friable, slightly sticky and slightly plastic; few fine roots; common fine pores; slightly effervescent; clear, wavy boundary.
- C2—18 to 27 inches, light brownish-gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; weak, coarse, prismatic structure; hard, friable, slightly sticky and plastic; common very fine pores; very few fine salt crystals; slightly effervescent; clear, wavy boundary.
- C3—27 to 37 inches, light brownish-gray (2.5Y 6/2) heavy silt loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, friable, sticky and plastic; common fine pores; few fine threads and crystals of salts; slightly effervescent; clear, wavy boundary.
- C4—37 to 51 inches, light brownish-gray (2.5Y 6/2) stratified silt loam and loamy sand, dark grayish brown (2.5Y 4/2) moist; massive; hard, friable, slightly sticky and slightly plastic; slightly effervescent; abrupt, wavy boundary.
- C5—51 to 72 inches, light yellowish-brown (2.5Y 6/4) silt loam, olive brown (2.5Y 4/4) moist; thin bands of brownish-yellow mottles; massive; slightly hard, friable, nonsticky and slightly plastic; few fine pores; slightly effervescent.

Hue ranges from 2.5Y to 7.5YR throughout. The soil between depths of 10 and 40 inches has an average texture of loam but in places contains thin strata of loamy sand and silty clay. The A horizon ranges from dark grayish-brown to brown loam, silt loam, and silty clay loam. The C horizon is light brownish gray, light yellowish brown, light brown, and pale brown.

**Korchea loam, 0 to 2 percent slopes (Kh).**—This nearly level soil is on low terraces and flood plains that are dissected by shallow channels. Areas are 2 to 20

acres in size. The soil has the profile described as representative of the series. Some brownish-yellow and gray mottles and a few salt crystals are below a depth of 20 inches along flowing streams.

Runoff is slow, and the hazard of erosion is slight. Areas of this soil on flood plains are subject to overflow 1 year out of 4. The soil is suited to irrigated and dryfarmed crops, hay, recreation, and range. Brush- and tree-covered areas along streams are suited to wildlife. Capability unit IIc-2 dryland, IIc-1 irrigated; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Korchea loam, 2 to 4 percent slopes (Kk).**—This gently sloping soil is on fans. Areas are 3 to 10 acres in size. The soil has a profile similar to the described as representative of the series, but it is steeper. Included in mapping are small spots of Farnuf loam.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIe-2 dryland, IIe-1 irrigated; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Korchea silt loam, 0 to 2 percent slopes (Km).**—This nearly level and gently sloping soil is on small fans and low terraces. It has a profile similar to the one described as representative of the series, but the upper 12 inches is silt loam and the underlying material contains fewer sandy layers.

Included with this soil in mapping are areas of soils along stream channels. These soils are subject to occasional flooding in spring.

Runoff is slow, and the hazard of erosion is slight. This soil is suited to irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIc-2 dryland, IIc-1 irrigated; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Korchea silt loam, frequently flooded (Kn).**—This nearly level and gently sloping soil is on small and irregularly shaped flood plains. Slopes are mostly 0 to 4 percent. The wider parts of the valley are dissected by several channels. The soil is flooded at least once each year. Some wet spots occur in old channels or oxbows. In places the water table is at a depth of 5 feet. The soil has a profile similar to the one described as representative of the series, but the surface layer is silty clay loam, the underlying material is silt loam, and there are wet spots.

Runoff is slow, and the hazard of erosion is severe. This soil is suited to range, wildlife, and recreation. Capability unit VIw-1 dryland; Overflow range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**Korchea silty clay loam, 0 to 2 percent slopes (Ko).**—This nearly level soil is on terraces that are 5 to 15 feet above the river flood plain. Areas are 5 to 30 acres in size. The soil has a profile similar to the one described as representative of the series, but the surface layer is silty clay loam about 8 inches thick.

Runoff is slow, and the hazard of erosion is slight. In places the water table is below a depth of 4 feet late in spring and early in summer. This soil is suited to irrigated and dryfarmed crops, hay, wildlife, recrea-

tion, and range. Capability unit IIc-2 dryland, IIc-1 irrigated; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Korchea silty clay loam, 2 to 4 percent slopes (Kp).**—This gently sloping soil is on fans and terraces. Areas range from 5 to 60 acres in size. Slopes are smooth and range from 200 to 500 feet long. The soil has a profile similar to the one described as representative of the series, but the surface layer is silty clay loam 6 to 10 inches thick.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIe-2 dryland, IIe-1 irrigated; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Korchea and Frazer soils, water table (KR).**—This undifferentiated soil group is made up of nearly level and gently sloping soils in stream bottoms. Slopes are 1 to 4 percent. The soils are intermixed; proportion and extent of the major soils are variable. They have profiles similar to the ones described as representative of their respective series, but they have a water table at a depth of 40 to 60 inches during the growing season and the texture of the surface layer is variable. Also, in a few places the lower part of the underlying material is reddish brown or light red.

Runoff is slow, and the hazard of streambank erosion is moderate. Overflow occurs 1 year out of 3. These soils are suited to range, pasture, recreation, and wildlife. Capability unit IVw-2 dryland; Overflow range site, 15- to 19-inch precipitation zone; windbreak suitability group 2W.

## Kyle Series

The Kyle series consists of deep, nearly level to strongly sloping, well-drained soils on fans and foot slopes. Slopes range from 0 to 15 percent. These soils formed in clay alluvium. Elevation ranges from 3,000 to 3,800 feet.

The native vegetation is mainly green needlegrass, western wheatgrass, big sagebrush, and woolly indian-wheat. Annual precipitation is 13 to 14 inches, the average annual soil temperature is 47° to 49° F, and the frost-free period is 110 to 125 days.

In a representative profile the surface layer is grayish-brown silty clay about 2 inches thick. The subsoil is grayish-brown and olive-gray clay and silty clay about 8 inches thick. The underlying material is light olive-gray, olive, and pale-olive clay that extends to a depth of 62 inches or more.

Permeability is very slow, and available water capacity is moderate or high. The effective rooting depth is 60 inches or more. These soils are used for irrigated and dryfarmed crops, wildlife, recreation, watershed, and range.

Representative profile of Kyle silty clay, 2 to 4 percent slopes, in grassland, 200 feet south and 100 feet west of the NE. corner sec. 12, T. 2 S., R. 30 E.

A—0 to 2 inches, grayish-brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; strong, very fine, granular structure; very hard, firm, very sticky and very plastic; many fine roots; clear, smooth boundary.



- B1—2 to 5 inches, grayish-brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; strong, fine, blocky structure; very hard, firm, very sticky and very plastic; common fine roots; slightly effervescent; clear, smooth boundary.
- B2—5 to 10 inches, olive-gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; moderate, medium, blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots and pores; strongly effervescent; gradual, wavy boundary.
- C1—10 to 22 inches, light olive-gray (5Y 5/2) clay, olive (5Y 4/3) moist; moderate, coarse and medium, blocky structure; extremely hard, very firm, very sticky and extremely plastic; few fine roots; strongly effervescent; very few fine, soft lime masses; clear, wavy boundary.
- C2—22 to 29 inches, olive (5Y 5/3) clay, olive (5Y 4/3) moist; moderate, coarse, blocky structure; extremely hard, very firm, very sticky and extremely plastic; common fine roots; few slickensides; strongly effervescent; few medium, soft lime masses; clear, wavy boundary.
- C3cs—29 to 39 inches, olive (5Y 5/3) clay, olive (5Y 4/3) moist; weak, coarse, blocky structure; extremely hard, very firm, very sticky and very plastic; very few fine roots; few slickensides; few medium gypsum crystals; strongly effervescent; gradual, wavy boundary.
- C4—39 to 62 inches, pale-olive (5Y 6/3) clay, olive (5Y 5/3) moist; massive; very hard, very firm, very sticky and very plastic; strongly effervescent; few gypsum crystals.

The solum ranges from 10 to 13 inches in thickness. If the soil is dry, cracks  $\frac{1}{2}$  inch to  $1\frac{1}{2}$  inches wide and several feet long extend downward. The soil between depths of 10 and 40 inches range from 50 to 60 percent clay. Below a depth of 40 inches, the soil in places is clay loam or silty clay loam. Coarse fragments are typically absent but in places range to as much as 10 percent. Hue is 2.5Y and 5Y throughout. The A horizon is grayish brown, olive gray, light olive gray, and light brownish gray. The B horizon is olive gray, dark grayish brown, light brownish gray, and light olive brown.

**Kyle silty clay, 0 to 2 percent slopes (Ks).**—This nearly level soil is on terraces and fans. Areas range from 5 to 300 acres in size. The soil has a profile similar to the one described as representative of the series, but it is less sloping. Included in mapping are small areas of Kyle clay, saline, and Vananda clay.

Runoff is slow, and the hazard of soil blowing is moderate on the bare soil. This soil is suited to irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIIe-3 dryland, IIIs-1 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Kyle silty clay, 2 to 4 percent slopes (Kt).**—This gently sloping soil is on fans and terraces. Areas are 5 to 60 acres in size. Slopes are smooth, and they range from 250 to 700 feet long. The soil has the profile described as representative of the series.

Included with this soil in mapping are spots of Vananda clay and Allentine clay. In cultivated areas the gray surface layer is puddled and cloddy.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIIe-3 dryland, IIIe-3 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Kyle silty clay, 4 to 8 percent slopes (Ku).**—This sloping soil is on fans and foot slopes. Areas range

from 10 to 30 acres in size. Slopes range from 150 to 300 feet long. The soil has a profile similar to the one described as representative of the series, but it is steeper. Included in mapping are small spots of Vananda clay.

Runoff is rapid, and the hazard of erosion is moderate. Most areas receive runoff from the hills and ridges above them. This soil is suited to dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIIe-3 dryland; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Kyle gravelly silty clay, 8 to 15 percent slopes (KV).**—This strongly sloping soil is on dissected fans and terraces in the clay shale uplands. It has a profile similar to the one described as representative of the series, but coarse fragments of gravel and cobble size are on the surface and throughout the soil. Coarse fragments range from 10 to 35 percent in the profile and 5 to 30 percent on the surface.

Included with this soil in mapping are patches of Kyle clay, Pierre clay, Allentine clay, and Heldt silty clay loam.

Runoff is rapid, and the hazard of erosion is moderate. This soil is suited to watershed, wildlife, recreation, range, and hay. Some of the least gravelly areas are suited to dryfarmed crops. Capability unit IVE-3 dryland; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Kyle clay, saline (Kw).**—This nearly level soil is on low terraces. Slopes are 0 to 2 percent. The soil has a profile similar to the one described as representative of the series, but it has visible salts in the upper 12 inches, a water table at or below a depth of 40 inches during the growing season, and brownish-yellow mottles in the underlying material. Effect of salinity is estimated to be moderate.

Runoff is slow, and the hazard of erosion is slight. This soil is suited to irrigated and dryfarmed crops only after reclamation. It is also suited to wildlife, recreation, range, and hay. Capability unit IVw-2 dryland; Saline Lowland range site, 10- to 14-inch precipitation zone; windbreak suitability group 3S.

## La Fonda Series

The La Fonda series consists of deep, gently sloping, well-drained, reddish-colored soils on fans and foot slopes. Slopes range from 2 to 4 percent. These soils formed in loam alluvium washed from red sedimentary shale and sandstone. Elevation ranges from 4,000 to 4,500 feet.

The native vegetation is mainly silver sagebrush, black sagebrush, prairie junegrass, broom snakeweed, and needleandthread. Annual precipitation is 11 to 13 inches, the average annual soil temperature is 47° to 50° F, and the frost-free period is 105 to 115 days.

In a representative profile the surface layer is reddish-brown very fine sandy loam and silt loam about 4 inches thick. The subsoil is reddish-brown loam about 8 inches thick. The substratum is light reddish-brown and light-brown loam and silt loam that extends to a depth of 60 inches or more.

Permeability is moderate, and available water ca-



capacity is high. The effective rooting depth is 60 inches or more. These soils are used for wildlife, recreation, and range. They are suitable for dryfarmed crops.

Representative profile of La Fonda loam, 2 to 4 percent slopes, in grassland, 600 feet north and 600 feet east of the SW. corner sec. 3, T. 7 S., R. 25 E.

- A11—0 to 2 inches, reddish-brown (5YR 5/3) very fine sandy loam, dark reddish brown (5YR 3/3) moist; weak, thin, platy structure; slightly hard, friable, nonsticky and slightly plastic; slightly effervescent; clear, smooth boundary.
- A12—2 to 4 inches, reddish-brown (5YR 4/3) loam, dark reddish brown (5YR 3/3) moist; moderate, thin, platy structure; slightly hard, friable, slightly sticky and slightly plastic; slightly effervescent; clear, smooth boundary.
- B21—4 to 8 inches, reddish-brown (5YR 4/3) loam, dark reddish brown (5YR 3/3) moist; moderate, medium, prismatic structure; hard, friable, sticky and plastic; slightly effervescent; gradual, wavy boundary.
- B22—8 to 12 inches, reddish-brown (5YR 5/3) loam, reddish brown (5YR 4/3) moist; weak, medium, prismatic structure parting to moderate, medium, blocky; hard, firm, sticky and plastic; strongly effervescent; gradual, wavy boundary.
- C1—12 to 19 inches, light reddish-brown (5YR 6/3) loam, reddish brown (5YR 4/3) moist; weak, medium, prismatic structure parting to moderate, medium, blocky; very hard, firm, sticky and plastic; strongly effervescent; clear, wavy boundary.
- C2ca—19 to 27 inches, light reddish-brown (5YR 6/3) loam, reddish brown (5YR 4/3) moist; moderate, medium, blocky structure; very hard, firm, sticky and plastic; strongly effervescent; common fine lime mottles and a few fine lime threads; gradual, wavy boundary.
- C3—27 to 41 inches, light-brown (7.5YR 6/4) loam, brown (7.5YR 5/4) moist; massive; hard, friable, slightly sticky and plastic; strongly effervescent; common lime mottles; clear, wavy boundary.
- C4—41 to 60 inches, light-brown (7.5YR 6/3) silt loam, brown (7.5YR 5/4) moist; massive; hard, friable, slightly sticky and plastic; strongly effervescent; few lime mottles.

The soil ranges from 0 to 25 percent coarse fragments. Hue ranges from 2.5YR to 7.5YR throughout. The A horizon is reddish-brown, light reddish-brown, and brown silt loam, loam, or very fine sandy loam. The B2 horizon is light reddish-brown and reddish-brown to light-brown loam or silt loam. The Cca horizon is light reddish brown, light brown, and pinkish gray.

**La Fonda loam, 2 to 4 percent slopes (La).**—This soil is on fans and terraces in the sedimentary uplands. Included in mapping are small areas of soils that are 10 to 30 percent gravel and that have a distinct layer of lime accumulation. Also included are spots of Stormitt gravelly loam.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to recreation, wildlife, range, hay, and limited dryfarmed crops. Capability unit IIIe-3 dryland; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 2M.

## Lap Series

The Lap series consists of shallow, undulating to strongly sloping, well-drained soils on mountainsides and ridgetops in the tilted sedimentary uplands. Slopes are mostly 8 to 15 percent, but they range to 2 percent. These channery soils formed in place from limestone

and hard siltstone. Elevation ranges from 3,900 to 6,000 feet.

The native vegetation is mainly Idaho fescue, Hoods phlox, bluebunch wheatgrass, and arrowleaf balsamroot. Annual precipitation is 15 to 18 inches, the average annual soil temperature is 44° to 47° F, and the frost-free period is 90 to 105 days.

In a representative profile the surface layer is grayish-brown channery loam about 4 inches thick. The underlying material is light brownish-gray and light-gray very channery loam. Hard, shattered limestone is at a depth of about 19 inches.

Permeability is moderate, and available water capacity is very low. The effective rooting zone is about 19 inches. These soils are used for range, watershed, recreation, and wildlife.

Representative profile of Lap channery loam, in an area of Lap association, undulating, in grassland, 1,200 feet west and 1,200 feet north of the SE. corner sec. 6, T. 6 S., R. 26 E.

- A1—0 to 4 inches, grayish-brown (10YR 4/2) channery loam, very dark grayish brown (10YR 3/2) moist; weak, very fine, granular structure; soft, very friable, nonsticky and slightly plastic; many very fine roots; 40 percent (volume) flat limestone fragments, 1 inch to 4 inches in diameter; clear, wavy boundary.
- C1—4 to 12 inches, light brownish-gray (10YR 6/2) very channery loam, dark grayish brown (10YR 4/2) moist; weak, fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; 50 percent (volume) flat limestone fragments; strongly effervescent; clear, wavy boundary.
- C2ca—12 to 19 inches, light-gray (10YR 7/2) very channery heavy loam, brown (10YR 5/3) moist; massive; slightly hard, friable, sticky and plastic; few very fine roots; 65 percent (volume) flat limestone fragments; strongly effervescent; irregular boundary.
- R—19 inches, hard, shattered limestone.

Depth to limestone ranges from 10 to 20 inches. The soil is loam or light clay loam that is 50 to 70 percent coarse limestone fragments of channer and flagstone size.

**Lap-Trulon complex, rolling (LCa).**—This complex is made up of rolling soils in the sedimentary uplands. It is 45 to 65 percent Lap channery loam, 35 to 50 percent Trulon loam, and 5 to 10 percent Rock outcrop. Slopes are mostly 8 to 15 percent, but they range to 4 percent. The Lap soil is around areas of Rock outcrop, and channers cover 15 to 25 percent of the surface. The Trulon soil has fewer surface channers and a thicker grass cover than the Lap soil. The Trulon soil in this complex has the profile described as representative of the Trulon series.

Runoff is medium, and the hazard of erosion is moderate. These soils are suited to range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 3L.

**Lap association, undulating (LCb).**—This association is made up of undulating soils in the sedimentary highlands. It is about equal parts of Lap loam and Lap channery loam. Slopes are mostly 4 to 8 percent, but they range to 2 percent. Areas range from 20 to 100 acres in size. Surface channers and gravel range from 0 to 10 percent on the loam soil and from 10 to



30 percent on the channery soil. The Lap loam has a profile similar to the one described as representative of the Lap series, but it has only a few coarse fragments in the surface layer. The Lap channery loam has the profile described as representative of the Lap series.

Runoff is medium, and the hazard of erosion is moderate. These soils are suited to range, wildlife, recreation, and watershed. Capability unit VI<sub>s</sub>-1 dryland; Shallow range site, 15- to 19-inch precipitation zone; windbreak suitability group 3M.

**Lap association, rolling (LCC).**—This association is made up of rolling and hilly soils in the sedimentary highlands. It is about equal parts of Lap loam and Lap stony loam. Slopes are mostly 8 to 15 percent, but they range to 20 percent. Areas are less than 100 acres in size. Surface channers and stones cover 0 to 10 percent of the loam soil and 15 to 40 percent of the stony loam soil. These soils have profiles similar to the ones described as representative of the Lap series, but the Lap loam is less than 15 percent coarse fragments and the Lap stony loam has coarse fragments of stone size.

Runoff is medium, and the hazard of erosion is moderate. This association is suited to range, wildlife, recreation, and watershed. Capability unit VI<sub>e</sub>-1 dryland; Shallow range site, 15- to 19-inch precipitation zone; windbreak suitability group 3M.

**Lap-Armington association, rolling (LCD).**—This association is made up of rolling to hilly and steep soils in the sedimentary highlands. It is about 45 percent Lap channery loam, 35 percent Armington silty clay, and 20 percent Reeder loam, Grail clay loam, and Rock outcrop. Slopes are mostly 8 to 15 percent, but they range to 35 percent. The Lap channery loam is on ridges and hills, along canyon rims, and above Rock outcrop on hillsides. The Armington silty clay is in bands, several hundred feet wide, between Rock outcrop on hillsides and above the Lap soil. The Lap soil in this complex has a profile similar to the one described as representative of the Lap series, but it is steeper. Scattered Douglas-fir grow on the Armington soil.

Runoff is rapid, and the hazard of erosion is severe. These soils are used for range, watershed, game range, and recreation. Capability unit VI<sub>e</sub>-1 dryland; Shallow range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

## Lavina Series

The Lavina series consists of shallow, undulating, well-drained soils on hard, platy shale and fine-grained sandstone uplands. Slopes are mostly 4 to 8 percent, but they range to 2 percent. These soils formed in place from the underlying shale and sandstone. Elevation ranges from 3,500 to 4,200 feet.

The native vegetation is mainly fringed sagewort, blue grama, broom snakeweed, bluebunch wheatgrass, needleandthread, and scurfpea. Annual precipitation is 10 to 14 inches, the average annual soil temperature is 47° F, and the frost-free period is 105 to 115 days.

In a representative profile the surface layer is brown loam about 2 inches thick. The subsoil is dark grayish-

brown, brown, and light brownish-gray loam and clay loam about 9 inches thick. The substratum is light-gray gravelly loam that is about 25 percent, by volume, chips of hard shale in the lower part. Hard shale and sandstone are at a depth of about 14 inches.

Permeability is slow, and available water capacity is very low. The effective rooting depth is 10 to 20 inches. These soils are used for range, wildlife, recreation, and watershed.

Representative profile of Lavina loam, in an area of Lavina-Travessilla loams undulating, 185 feet east of trail, 310 feet south and 75 feet east of the center sec. 33, T. 4 S., R. 29 E.

A1—0 to 2 inches, brown (10YR 5/2) loam, dark brown (10YR 3/2) moist; moderate, thin, platy structure; slightly hard, friable, slightly sticky and slightly plastic; few hard shale chips; clear, smooth boundary.

B1—2 to 4 inches, dark grayish-brown (10YR 4/2) loam, dark brown (10YR 3/3) moist; weak, medium, prismatic structure parting to moderate, coarse, platy; hard, friable, sticky and plastic; few hard shale chips; clear, smooth boundary.

B2t—4 to 8 inches, brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; weak, medium, prismatic structure parting to moderate, very fine, subangular blocky; hard, firm, very sticky and plastic; thin, patchy clay films on peds; few hard shale chips; gradual, wavy boundary.

B3ca—8 to 11 inches, light brownish-gray (10YR 6/2) clay loam, brown (10YR 5/3) moist; weak, medium, prismatic structure breaking to weak, very fine, subangular blocky; hard, firm, sticky and plastic; strongly effervescent; few fine lime mottles; few hard shale chips; gradual, wavy boundary.

Cca—11 to 14 inches, light-gray (10YR 7/2) gravelly loam, pale brown (10YR 6/3) moist; weak, coarse, prismatic structure parting to weak, very fine, subangular blocky; strongly effervescent; common medium lime mottles; 25 percent (volume) hard shale chips; abrupt, wavy boundary.

R—14 to 15 inches, hard, ¼-inch to 1-inch thick, platy shale and sandstone.

Depth to bedrock ranges from 10 to 20 inches. The soil ranges from 0 to 30 percent coarse fragments of gravel and channer size. Hue is 10YR and 2.5Y. The A horizon is brown, grayish-brown, and light brownish-gray loam or sandy loam. The B2t horizon is brown, dark brown, grayish brown, and dark grayish brown and ranges from 30 to 45 percent clay. The Cca horizon is light brownish gray, light gray, and light yellowish brown. The C horizon is generally absent where depth to bedrock is less than 12 inches.

**Lavina-Travessilla loams, undulating (LD).**—This complex is made up of undulating soils on smooth, slightly tilted, hard limestone and shale uplands. It is 40 to 60 percent Lavina loam, 25 to 40 percent Travessilla loam, and 5 to 15 percent Travessilla channery loam, Rock outcrop, and Renohill clay loam. Slopes are mostly 4 to 8 percent, but they range to 2 percent. Slopes are 150 to 300 feet long. The Travessilla loam in this complex has a profile similar to the one described as representative of Travessilla series, but the surface layer is 5 to 15 percent flat sandstone fragments of gravel size. The Lavina soil has the profile described as representative of the Lavina series.

Runoff is medium, and the hazard of erosion is moderate. These soils are suited to range, wildlife, recreation, watershed, pasture, and dryfarmed crops. Capability unit IV<sub>s</sub>-2 dryland; Shallow range site, 10- to 14-inch precipitation zone; windbreak suitability group 3M.



## Lennep Series

The Lennep series consists of deep, gently sloping and undulating, well-drained, sodium-affected soils on fans, terraces, and foot slopes in the sedimentary uplands. Slopes are mostly 2 to 8 percent, but they range to 0 percent. These soils formed in fine-textured alluvium. Elevation ranges from 3,500 to 4,300 feet.

The native vegetation is mainly western wheatgrass, green needlegrass, big sagebrush, and prairie junegrass. Annual precipitation is 14 to 16 inches, the average annual soil temperature is 45° to 47° F, and the frost-free period is 95 to 115 days.

In a representative profile the upper part of the surface layer is light brownish-gray loam about 2 inches thick. The lower part of the surface layer is grayish-brown light clay loam about 2 inches thick. The subsoil is grayish-brown, dark grayish-brown, light olive-brown, and light yellowish-brown silty clay loam and clay about 23 inches thick. The substratum is light yellowish-brown and pale-yellow silty clay and clay that extends to a depth of 73 inches or more.

Permeability is slow, and available water capacity is moderate or high. The effective rooting depth is 60 inches or more. These soils are used for dryfarmed crops, wildlife, and range. They are suitable for irrigation.

Representative profile of Lennep loam, 2 to 4 percent slopes, in grassland, 660 feet north and 2,100 feet east of the SW. corner sec. 18, T. 4 S., R. 34 E.

- A2—0 to 2 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; moderate, medium, platy structure; soft, friable, nonsticky and slightly plastic; many very fine roots; clean silt and sand grains coating the tops of the plates; clear, smooth boundary.
- A&B—2 to 4 inches, grayish-brown (10YR 5/2) light clay loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, platy structure; hard, friable, sticky and plastic; common very fine roots; many very fine pores; clean silt and sand grains coating peds; clear, wavy boundary.
- B&A—4 to 8 inches, grayish-brown (10YR 5/2) heavy silty clay loam, very dark grayish brown (10YR 3/2) moist; strong, medium, prismatic structure parting to moderate, coarse, platy; hard, firm, very sticky and plastic; common very fine roots; many very fine tubular pores; thin, patchy clay films on peds coated with clean silt and sand grains; clear, smooth boundary.
- B21t—8 to 12 inches, dark grayish-brown (10YR 4/2) light clay, dark brown (10YR 3/3) moist; strong, medium, prismatic structure parting to strong, medium and fine, blocky; very hard, very firm, very sticky and very plastic; few very fine roots; common very fine tubular pores; thin, continuous clay films on peds; gradual, wavy boundary.
- B22t—12 to 16 inches, grayish-brown (2.5Y 5/2) clay, olive brown (2.5Y 4/4) moist; strong, coarse, prismatic structure parting to strong, coarse, blocky; extremely hard, very firm, very sticky and very plastic; few very fine roots; few very fine tubular pores; thin, continuous clay films on peds and coating rims and walls of pores; gradual, wavy boundary.
- B23t—16 to 23 inches, light olive-brown (2.5Y 5/4) heavy clay, olive brown (2.5Y 4/4) moist; strong, coarse, prismatic structure parting to strong, coarse, blocky; extremely hard, extremely firm, very sticky and extremely plastic; few very fine roots; few very fine tubular pores; continuous clay films on

peds; fine pores partly closed by clay flow; clear, wavy boundary.

- B3cacs—23 to 27 inches, light yellowish-brown (2.5Y 6/4) clay, light olive brown (2.5Y 5/4) moist; weak, coarse, blocky structure; extremely hard, very firm, very sticky and very plastic; few very fine roots between blocks; few very fine tubular pores; slightly effervescent; many seams and threads of gypsum crystals; common masses of segregated lime; clear, wavy boundary.
- C1cacs—27 to 32 inches, light yellowish-brown (2.5Y 6/4) light clay, light olive brown (2.5Y 5/4) moist; massive; very hard, very firm, very sticky and very plastic; few very fine roots; few very fine tubular pores; strongly effervescent; many seams and threads of gypsum; common masses of segregated lime; clear, wavy boundary.
- C2cacs—32 to 41 inches, pale-yellow (2.5Y 7/4) heavy silty clay, light yellowish brown (2.5Y 6/4) moist; massive; very hard, firm, sticky and very plastic; strongly effervescent; common gypsum crystals; common segregated lime mottles; clear, wavy boundary.
- C3—41 to 73 inches, pale-yellow (2.5Y 7/4) heavy silty clay, light yellowish brown (2.5Y 6/4) moist; massive; very hard, firm, sticky and plastic; strongly effervescent; few segregated lime masses.

Hue ranges from 2.5Y to 7.5YR throughout. The A2 and B&A horizons range from 7 to 12 inches in combined thickness. The noncalcareous part of the soil ranges from 12 to 26 inches in thickness. The A2 horizon is grayish brown or light brownish gray. The A&B horizon is light to heavy silty clay loam or clay loam. The B2t horizon is 50 to 60 percent clay. It is brown, grayish brown, light olive brown, and dark grayish brown. The Cca horizon is pale-yellow or light yellowish-brown clay, silty clay, or silty clay loam.

**Lennep loam, 2 to 4 percent slopes (Lea).**—This soil is on fans and terraces. Areas are 10 to 15 acres in size. The soil has the profile described as representative of the series.

Included with this soil in mapping are spots of Adger clay. Also included are some areas of soils that are similar to this Lennep soil, but shale bedrock is below a depth of 36 inches.

Runoff is slow, and the hazard of erosion is slight. This soil is suited to dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIIe-2 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 2S.

**Lennep loam, 4 to 8 percent slopes (Leb).**—This soil is on fans and foot slopes. Areas are 20 to 50 acres in size. The soil has a profile similar to the one described as representative of the series, but it is steeper.

Included with this soil in mapping are spots of Adger clay. Also included are some areas of soils that are similar to this Lennep soil, but shale bedrock is below a depth of 36 inches.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IYe-2 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 2S.

**Lennep-Adger complex, gently undulating (Lec).**—This complex is made up of gently undulating soils on terraces and fans. It is 70 to 85 percent Lennep loam and 15 to 30 percent Adger clay. Slopes are mostly 2 to 4 percent, but they range to 0 percent. The Adger soil is in microdepressions, and in cultivated areas it has a cloddy surface layer. Included in mapping are some



areas of soils that have shale bedrock below a depth of 36 inches.

Runoff is slow, and the hazard of erosion is slight. These soils are suited to dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIIe-2 dryland; Pan Spots range site, 15- to 19-inch precipitation zone; windbreak suitability group 3S.

**Lennep-Adger complex, undulating (Ld).**—This complex is made up of undulating soils on fans and terraces. It is 55 to 70 percent Lennep loam and 30 to 45 percent Adger clay. Slopes are 4 to 8 percent. The Adger soil is in microdepressions that are 3 to 6 inches deep. In cultivated fields the Adger soil is cloddy. Included in mapping are some areas of soils that have shale bedrock below a depth of 36 inches.

Runoff is medium, and the hazard of erosion is moderate. These soils are suited to dryfarmed crops, pasture, wildlife, recreation, watershed, and range. Capability unit IVe-2 dryland; Pan Spots range site, 15- to 19-inch precipitation zone; windbreak suitability group 3S.

## Lismas Series

The Lismas series consists of shallow, undulating to hilly or steep, well-drained soils on dissected sedimentary uplands. Slopes are mostly 4 to 35 percent, but they range to 50 percent. These soils formed in place from clay shale. Elevation ranges from 3,000 to 3,800 feet.

The native vegetation is mainly western wheatgrass, Sandberg bluegrass, wild carrot, white loco, greasewood, and Hoods phlox. Annual precipitation is 12 to 14 inches, the average annual soil temperature is 47° to 50° F, and the frost-free period is 115 to 125 days.

In a representative profile the surface layer is light olive-gray clay about 1 inch thick. The underlying material is olive-gray and light olive-gray clay. Platy shale is at a depth of about 18 inches. Fine, weathered shale chips make up 10 to 30 percent of the soil material.

Permeability is very slow, and available water capacity is very low. The effective rooting depth is 10 to 20 inches. Most of these soils are used for watershed, wildlife, recreation, and range. A few areas are included with deeper soils and are used for dryfarmed crops.

Representative profile of Lismas clay, undulating, in grassland, 600 feet north and 250 feet west of the SE corner sec. 21, T. 2 S., R. 32 E.

A—0 to 1 inch, light olive-gray (5Y 6/2) clay, olive gray (5Y 4/2) moist; strong, very fine, granular structure; slightly hard, friable, very sticky and very plastic; slightly effervescent; clear, smooth boundary.

C1—1 inch to 6 inches, olive-gray (5Y 5/2) clay, olive (5Y 4/2) moist; weak, moderate, granular structure; hard, firm, very sticky and very plastic; strongly effervescent; few weathered shale chips; clear, wavy boundary.

C2cs—6 to 13 inches, olive-gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; massive; hard, firm, very sticky and very plastic; strongly effervescent; common shale chips and a few gypsum crystals; gradual, wavy boundary.

C3—13 to 18 inches, light olive-gray (5Y 6/2) clay, olive (5Y 4/3) moist; weak, platy structure; hard, firm,

very sticky and very plastic; strongly effervescent; many shale chips and a few gypsum crystals; gradual, wavy boundary.

C4—18 to 24 inches, light olive-gray (5Y 6/2) platy clay shale, 1/8 to 1/4 inch thick, olive gray (5Y 4/2) moist; strongly effervescent.

Depth to shale ranges from 10 to 20 inches. Hue is 2.5Y and 5Y throughout. The soil ranges from 45 to 60 percent clay throughout.

**Lismas clay, undulating (LF).**—This undulating and rolling soil is on dissected sedimentary uplands. Areas extend from the valley bottom to the base of steep ridges that border the valley. Slopes are mostly 4 to 8 percent, but they range to 10 percent. This soil has the profile described as representative of the series. Included in mapping are areas of Shale outcrop and some 1/4- to 1-acre patches of Vananda clay.

Runoff is rapid, and the hazard of erosion is severe. This soil is suited to range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Shallow Clay range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

**Lismas gravelly clay, rolling (LG).**—This rolling soil is on the edges of dissected gravelly benches and terraces where drainageways have cut through the gravelly material into the underlying shale. The terrain consists of narrow ridges of gravelly soils separated by closely spaced coulees or drainageways. The Lismas soil is on the sides and bottoms of drainageways. Slopes are short. They are 8 to 12 percent on ridgetops, at the heads of drainageways, and in shallow coulees, and 15 to 20 percent on the sides of deep coulees and ridges. The soil has a profile similar to the one described as representative of the series, but the surface layer is gravelly. Included in mapping are patches of Clapper, Colby, and Keiser soils on ridges.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Shallow Clay range site, 10- to 14-inch precipitation zone; windbreak suitability group 3M.

**Lismas gravelly clay, hilly (LH).**—This hilly soil is along the edges of high gravelly terraces that are dissected deeply by coulees, exposing the dark-gray underlying shale. Areas are 80 to 300 acres in size. In places the soil is on a steep escarpment, 200 to 300 feet high, at the heads of deep drainageways below the high gravelly terrace remnants. Scattered fragments of gravel size are on the surface of all the soils below the terrace edges. The soil has a profile similar to the one described as representative of the series, but the surface layer is gravelly clay.

Included with this soil in mapping are spots of Hesper silty clay loam, Richfield silt loam, Clapper gravelly loam, and Shale outcrop. Included soils make up 10 to 30 percent of the total area of this mapping unit.

Runoff is rapid, and the hazard of erosion is severe. Runoff water carries large amounts of sediment. This soil is suited to range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Shallow Clay range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

**Lismas-Shale outcrop complex, rolling (LK).**—This complex is made up of rolling to hilly and moderately



steep soils in the sedimentary uplands. It is about 75 percent Lismas clay and 10 percent Shale outcrop. Slopes are mostly 8 to 15 percent, but they range to 20 percent. The Lismas soil in this complex has a profile similar to the one described as representative of the Lismas series, but the underlying shale material has many crystals of gypsum. Included in mapping are areas of Pierre clay and Vananda clay that make up about 15 percent of the total area of this mapping unit.

Runoff is medium, and the hazard of erosion is moderate. These soils are suited to range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Shallow Clay range site, 10- to 14-inch precipitation zone; windbreak suitability group 3M.

**Lismas-Shale outcrop complex, steep (LM).**—This complex is made up of moderately steep and very steep soils in the sedimentary uplands. It is 70 to 90 percent Lismas clay and 10 to 30 percent Shale outcrop. Slopes are mostly 20 to 35 percent, but they range to 75 percent. The Lismas soil is on narrow ridges, and Shale outcrop is on the lower sides of deep drainageways. The Lismas soil in this complex has a profile similar to the one described as representative of the Lismas series, but the underlying material contains many crystals of gypsum. Included in mapping are spots of Pierre clay and Vananda clay.

Runoff is rapid, and the hazard of erosion is severe. Runoff water carries large amounts of sediment. These soils are suited to range, wildlife, recreation, and watershed. Capability unit VIIe-1 dryland; Shallow Clay range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

**Lismas-Vananda clays, undulating (LN).**—This complex is made up of undulating soils in the sedimentary uplands. It is about 25 percent Lismas clay, 60 percent Pierre clay, and 15 percent Vananda clay. Slopes are 4 to 8 percent. The Vananda soil has a crusted surface layer and is covered with greasewood. The Lismas soil is on the crests of surface undulations and the sides of deep drainageways. The Lismas soil in this complex has a profile similar to the one described as representative of the Lismas series, but it is shallower over shale, and it contains many crystals of gypsum. Also, in plowed areas it is light olive gray.

Runoff is medium, and the hazard of erosion is moderate. These soils are suited to wildlife, recreation, watershed, range, pasture, and dryfarmed crops. Capability unit IVe-3 dryland; Shallow Clay range site, 10- to 14-inch precipitation zone; windbreak suitability group 2S.

## Lohmiller Series

The Lohmiller series consists of deep, nearly level to steep and undulating, well-drained soils on flood plains, fans, and foot slopes. Slopes range from 0 to 35 percent. These soils formed in calcareous silty clay loam alluvium. Elevation ranges from 2,800 to 3,600 feet.

The native vegetation is mainly western wheatgrass, blue grama, silver sagebrush, and Sandberg bluegrass. Annual precipitation is 12 to 14 inches, the average

annual soil temperature is 47° to 49° F, and the frost-free period is 115 to 125 days.

In a representative profile the surface layer is light brownish-gray silty clay loam about 12 inches thick. The underlying material is light brownish-gray, light yellowish-brown, and pale-olive stratified silty clay loam, silt loam, and silty clay that extends to a depth of 60 inches or more.

Permeability is moderately slow, and available water capacity is high. The effective rooting depth is 60 inches or more. These soils are used for irrigated and dryfarmed crops, wildlife, recreation, watershed, and range.

Representative profile of Lohmiller silty clay loam, 0 to 2 percent slopes, in a cultivated area, 1,320 feet south and 500 feet west of the NE. corner sec. 30, T. 3 N., R. 34 E.

Ap—0 to 6 inches, light brownish-gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; few very fine pores; strongly effervescent; clear, smooth boundary.

A1—6 to 12 inches, light brownish-gray (2.5Y 6/2) heavy silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate, angular blocky structure; hard, firm, very sticky and very plastic; few very fine roots; few very fine pores; strongly effervescent; clear, wavy boundary.

C1—12 to 17 inches, light brownish-gray (2.5Y 6/2) light silty clay loam, light olive brown (2.5Y 5/4) moist; massive; hard, friable, sticky and plastic; few very fine roots; few very fine pores; strongly effervescent; gradual, wavy boundary.

C2—17 to 33 inches, pale-olive (5Y 6/3) heavy silty clay loam stratified with 1-inch to 2-inch bands of heavy silt loam, olive (5Y 5/3) moist; massive; hard, friable, very sticky and very plastic; very few fine roots; common fine pores; strongly effervescent; clear, wavy boundary.

C3—33 to 60 inches, light yellowish-brown (2.5Y 6/4) light silty clay stratified with thin bands of silty clay loam, light olive brown (2.5Y 5/4) moist; massive; very hard, firm, very sticky and very plastic; few fine pores; strongly effervescent.

The soil below a depth of 30 inches ranges from 0 to 10 percent coarse fragments. Hue is 2.5Y and 5Y throughout. The Ap horizon is light brownish gray, brownish gray, or olive gray and ranges from 6 to 12 inches in thickness.

### Lohmiller silty clay loam, 0 to 2 percent slopes (Lo).

—This nearly level soil is in 5- to 75-acre areas on low terraces and flood plains. It has the profile described as representative of the series.

Included with this soil in mapping in small stream valleys are areas of soils that are similar to this Lohmiller soil but that have more strata of silt loam, loam, and sandy loam below a depth of 20 inches. Also included are areas of Haverson loam.

Runoff is slow, and the hazard of erosion is slight. The areas on the flood plain are subject to overflow about 1 year out of 5. This soil is suited to irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIIe-3 dryland, IIs-1 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

### Lohmiller silty clay loam, 2 to 4 percent slopes (Lp).

—This gently sloping soil is in 5- to 30-acre areas on fans. A few areas are on flood plains where old partly filled channels, 1 foot to 3 feet deep, occur. The soil



has a profile similar to the one described as representative of the series, but it is steeper.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIIe-3 dryland, IIe-1 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Lohmiller silty clay loam, 4 to 8 percent slopes (Lr).**—This gently sloping soil is on fans, foot slopes, and terraces. The large fans and terraces are dissected in many places by uncrossable dry stream channels. Most areas on foot slopes receive runoff from soils above them. The soil has a profile similar to the one described as representative of the series, but it is steeper.

Runoff is rapid, and the hazard of erosion is moderate. This soil is suited to irrigated and dryfarmed crops, hay, watershed, wildlife, recreation, and range. Capability unit IIIe-3 dryland, IIIe-1 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Lohmiller silty clay loam, 8 to 15 percent slopes (Ls).**—This strongly sloping soil is on deeply dissected fans and foot slopes. Narrow gullies divide the soil into patches of 10 acres or less. Some residual soils are on the wide foot slopes. Between the gullies, slopes are 200 to 300 feet long and range from 4 to 8 percent. On the gully sides, slopes are 20 to 35 percent. The soil has a profile similar to the one described as representative of the series, but it is steeper. Included in mapping are spots where erosion has removed the upper 2 to 6 inches of the surface layer.

Runoff is rapid, and the hazard of erosion is severe. Gully erosion is active late in spring. This soil is suited to range, wildlife, recreation, watershed, hay, pasture, and dryfarmed crops. Capability unit IVe-3 dryland; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Lohmiller silty clay, saline, 0 to 2 percent slopes (Lt).**—This nearly level soil is on low terraces and flood plains. It has a profile similar to the one described as representative of the series, but the surface layer is silty clay. Also, this soil is moderately affected by saline salts, visible salt crystals are in the upper 12 inches, and the water table is at a depth of 3 to 5 feet.

Runoff is slow, and the hazard of erosion is slight. This soil is suited to irrigated and dryfarmed crops after reclamation. It is used for hay, wildlife, recreation, and range. Capability unit IVs-2 dryland; Saline Lowland range site, 10- to 14-inch precipitation zone; windbreak suitability group 2S.

**Lohmiller silty clay, saline, 2 to 4 percent slopes (Lu).**—This gently sloping soil is on fans, typically below irrigation canals or in shallow drainageways. It has a profile similar to the one described as representative of the series, but the surface layer is silty clay. Also, visible salt crystals are in the upper 12 inches, the soil is moderately affected by saline salts, and the water table is between depths of 3 and 5 feet.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to irrigated and dryfarmed crops after reclamation. It is used for hay, wildlife, recreation, and range. Capability unit IVs-2

dryland; Saline Lowland range site, 10- to 14-inch precipitation zone; windbreak suitability group 2S.

**Lohmiller-Midway silty clay loams, undulating (LV).**—This complex is made up of undulating and rolling soils on shale hills. It is about 75 percent Lohmiller silty clay loam and 25 percent Midway silty clay loam. Slopes are mostly 4 to 8 percent, but they range to 15 percent. The Midway soil is on low knolls and ridges, and it is surrounded by smoothly sloping patches of the Lohmiller soil. The highest knolls and ridges rise to 15 to 30 feet above the Lohmiller soils. Slopes are 4 to 10 percent on the Lohmiller soil and 10 to 15 percent on the Midway soil. The Lohmiller soil in this complex has a profile similar to the one described as representative of the Lohmiller series, but it is steeper. Included in mapping are spots of Lohmiller soils that are underlain by shale at a depth of 3 to 5 feet.

Runoff is medium, and the hazard of erosion is moderate. These soils are suited to watershed, recreation, wildlife, range, hay, and pasture. Capability unit IVe-3 dryland; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 2M.

## Macar Series

The Macar series consists of deep, gently sloping, well-drained soils on fans and foot slopes in dissected sedimentary highlands. Slopes range from 4 to 8 percent. These soils formed in loam alluvium. Elevation ranges from 3,500 to 4,000 feet.

The native vegetation is mainly Hoods phlox, western yarrow, western wheatgrass, and silver sagebrush. Annual precipitation is 14 to 16 inches, the average annual soil temperature is 45° to 47° F, and the frost-free period is 90 to 115 days.

In a representative profile the surface layer is grayish-brown loam about 3 inches thick. The subsoil is brown loam about 10 inches thick. The substratum is brown and pale-brown loam, clay loam, and gravelly clay loam that extends to a depth of 61 inches or more.

Permeability is moderate, and available water capacity is high. The effective rooting depth is 60 inches or more. These soils are used for dryfarmed and irrigated crops, watershed, wildlife, recreation, and range.

Representative profile of Macar loam, 4 to 8 percent slopes, 2,600 feet north and 990 feet east of the SW. corner sec. 21, T. 7 S., R. 39 E.

A1—0 to 3 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate, thin, platy structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and common very fine roots; few fine shale chips; slightly effervescent; clear, smooth boundary.

B21—3 to 8 inches, brown (7.5YR 5/3) loam, dark brown (7.5YR 4/3) moist; weak, medium, prismatic structure; hard, friable, slightly sticky and slightly plastic; common very fine and few fine roots; common very fine pores; slightly effervescent; few fine shale chips; gradual, wavy boundary.

B22—8 to 13 inches, brown (7.5YR 5/3) loam, dark brown (7.5YR 4/3) moist; moderate, coarse, prismatic structure; hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine pores; few fine shale chips; slightly effervescent; gradual, wavy boundary.

C1—13 to 19 inches, brown (7.5YR 5/3) loam, dark brown (7.5YR 4/3) moist; moderate, coarse, prismatic structure; hard, friable, slightly sticky and slightly



plastic; common very fine roots; many very fine pores; few fine shale chips; slightly effervescent; gradual, wavy boundary.

C2ca—19 to 34 inches, pale-brown (10YR 6/3) light clay loam, brown (10YR 5/3) moist; weak, coarse, prismatic structure; hard, friable, sticky and plastic; few very fine roots; common very fine pores; few fine shale chips; strongly effervescent; few fine lime threads in lower part; clear, wavy boundary.

C3—34 to 47 inches, pale-brown (10YR 6/3) gravelly light clay loam, yellowish brown (10YR 4/3) moist; massive; hard, friable, sticky and plastic; few very fine roots; few very fine pores; 15 percent (volume) fine shale chips; strongly effervescent; gradual, wavy boundary.

C4—47 to 61 inches, pale-brown (10YR 6/3) loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; strongly effervescent.

The soil between depths of 10 and 40 inches ranges from loam to light clay loam. Coarse fragments make up 0 to 20 percent of the C horizon. Hue is 7.5YR and 10YR throughout. The A horizon is grayish brown and brown. The B horizon is grayish brown, light brownish gray, and brown. The C horizon ranges from 0 to 20 percent (volume) coarse fragments. The Cca horizon is pale brown, light brown, and pink.

**Macar loam, 4 to 8 percent slopes (Ma).**—This soil is on foot slopes and fans. Areas are 5 to 15 acres in size. Most areas receive runoff from soils above them. Slopes range from 100 to 300 feet long. Included in mapping are small areas of Farnuf loam.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to irrigated and dry-farmed crops, hay, watershed, wildlife, recreation, and range. Capability unit IIIe-3 dryland, IIIe-1 irrigated; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

## Maginnis Series

The Maginnis series consists of shallow, hilly and very steep, excessively drained soils on sedimentary uplands. Slopes range from 15 to 65 percent. These soils formed in place in material weathered from hard shale and sandstone. Elevation ranges from 4,000 to 5,000 feet.

The native vegetation is mainly Idaho fescue, western wheatgrass, bluebunch wheatgrass, scurfpea, licorice, and prairie junegrass. Annual precipitation is 14 to 16 inches, the average annual soil temperature is 45° to 47° F, and the frost-free period is 90 to 105 days.

In a representative profile the surface layer is grayish-brown channery loam and channery silty clay loam about 6 inches thick. The subsoil is grayish-brown channery silty clay about 4 inches thick. The substratum is light yellowish-brown very channery clay. Hard, laminated shale and sandstone are at a depth of about 16 inches.

Permeability is moderately slow, and available water capacity is very low. The effective rooting depth is 20 inches. These soils are used for range watershed, recreation, and wildlife.

Representative profile of Maginnis channery loam, in an area of Maginnis-Shale outcrop complex, very steep, in grassland, 1,800 feet south and 200 feet east of the NW. corner sec. 33, T. 4 S., R. 28 E.

A11—0 to 3 inches, grayish-brown (2.5Y 5/2) channery heavy loam, very dark grayish brown (2.5Y 3/2) moist; weak, very fine, granular structure; soft, friable, slightly sticky and plastic; many very fine roots; 20 percent thin, flat, hard sandstone fragments; clear, smooth boundary.

A12—3 to 6 inches, grayish-brown (2.5Y 5/2) channery silty clay loam, very dark grayish brown (2.5Y 3/2) moist; moderate, medium, granular structure; hard, friable, sticky and plastic; 25 percent (volume) sandstone fragments of channer size; many very fine roots matted between layered hard sandstone channers; clear, wavy boundary.

B2—6 to 10 inches, grayish-brown (2.5Y 5/2) channery silty clay, olive brown (2.5Y 4/4) moist; moderate, fine, blocky structure; very hard, firm, very sticky and very plastic; 35 percent (volume) sandstone fragments of channer size; many very fine roots matted between layered hard sandstone channers; clear, wavy boundary.

C—10 to 16 inches, light yellowish-brown (2.5Y 6/4) very channery clay, light olive brown (2.5Y 5/4) moist; massive; very hard, firm, very sticky and very plastic; common micro roots; 50 percent (volume) hard sandstone fragments of channer size; abrupt, wavy boundary.

R—16 to 17 inches, hard, platy, thinly laminated sandstone and shale; thin lime coatings on the bottoms of the plates.

Depth to bedrock ranges from 10 to 20 inches. The upper 6 inches of the soil ranges from 5 to 35 percent fragments of channer and gravel size, and below a depth of 6 inches, from 45 to 80 percent. Hue is 10YR and 2.5Y throughout. The A1 horizon is grayish brown and dark grayish brown. The B2 horizon is dark brown, dark grayish brown, and grayish brown. The B and C horizons range from 35 to 45 percent clay.

## Maginnis-Shale outcrop complex, very steep (MB).

This complex is made up of very steep soils in the sedimentary uplands. It is 40 to 60 percent Maginnis channery loam and 40 to 60 percent Shale outcrop. Slopes are 35 to 65 percent on the Maginnis soil and 45 to 90 percent on the Shale outcrop. The Maginnis soil in this complex has the profile described as representative of the Maginnis series. Included in mapping, and making up 5 to 10 percent of the area of this mapping unit, are areas of red-colored Pierre clay and Kyle clay.

Runoff is rapid, and the hazard of erosion is severe. These soils are suited to range, watershed, recreation, and wildlife. Capability unit VIIe-1 dryland; Thin Breaks range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**Maginnis-Windham complex, hilly (MC).**—This complex is made up of hilly and very steep soils on gravelly terraces and benches. It is about 65 percent Maginnis channery loam and 35 percent Windham gravelly loam. Slopes are mostly 15 to 35 percent, but they range to 50 percent. The Windham soil has slopes of 15 to 25 percent, and the Maginnis soil has slopes of 25 to 50 percent. The Windham soil is on the upper sides and along the rims of drainageways. The Maginnis soil is on the lower eroded sides and in the bottoms of drainageways. A few spots of Shale outcrop are included with the Maginnis soil in mapping, and gravel is scattered on the surface.

Runoff is rapid, and the hazard of erosion is severe. These soils are used for range, watershed, and wildlife. Capability unit VIe-1 dryland; Thin Hilly range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.



## Marias Series

The Marias series consists of deep, nearly level to strongly sloping, well-drained soils on terraces, fans, and foot slopes. Slopes range from 0 to 15 percent. These soils formed in clay alluvium. Elevation ranges from 3,600 to 4,200 feet.

The native vegetation is mainly scurfpea, western yarrow, broom snakeweed, and western wheatgrass. Annual precipitation is 14 to 16 inches, the average annual soil temperature is 44° to 46° F, and the frost-free period is 95 to 115 days.

In a representative profile the surface layer is grayish-brown and dark grayish-brown silty clay and clay about 4 inches thick. The subsoil is dark grayish-brown clay about 6 inches thick. The substratum is grayish-brown and olive clay and gray silty clay that extends to a depth of 60 inches or more.

Permeability is very slow, and available water capacity is moderate or high. The effective rooting depth is 60 inches or more. These soils are used for irrigated and dryfarmed crops, watershed, wildlife, recreation and range.

Representative profile of Marias clay, 4 to 8 percent slopes, in grassland, 2,000 feet west and 50 feet south of the NE. corner sec. 12, T. 8 S., R. 33 E.

- A11—0 to 1 inch, grayish-brown (2.5Y 5/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; weak, coarse, granular structure; hard, firm, sticky and plastic; many fine roots; clear, smooth boundary.
- A12—1 inch to 4 inches, dark grayish-brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate, fine, blocky structure; very hard, firm, very sticky and very plastic; common fine roots; few fine pores; clear, smooth boundary.
- B2—4 to 10 inches, dark grayish-brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate, coarse, prismatic structure parting to strong, fine and medium, blocky; very hard, very firm, very sticky and very plastic; common fine roots; few very fine pores; slightly effervescent; clear, wavy boundary.
- C1—10 to 16 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak, coarse, prismatic structure parting to moderate, coarse, blocky; very hard, very firm, very sticky and very plastic; few fine roots; common fine pores; strongly effervescent; gradual, wavy boundary.
- C2—16 to 24 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate, coarse, blocky structure; very hard, very firm, very sticky and extremely plastic; few fine roots; few very fine pores; strongly effervescent; few medium, soft lime masses; gradual, wavy boundary.
- C3ca—24 to 34 inches, olive (5Y 5/3) clay, olive gray (5Y 4/2) moist; moderate, coarse, blocky structure; very hard, extremely firm, very sticky and extremely plastic; very few fine roots; few fine pores; few slickensides; strongly effervescent; common coarse and medium, soft lime masses; clear, wavy boundary.
- C4—34 to 48 inches, olive (5Y 5/3) clay, olive gray (5Y 4/2) moist; strong, coarse, blocky structure; very hard, extremely firm, very sticky and extremely plastic; very few fine roots; few fine pores; many slickensides; strongly effervescent; clear, wavy boundary.
- C5—48 to 60 inches, gray (5Y 5/1) silty clay, olive gray (5Y 4/2) moist; massive; very hard, extremely firm, very sticky and extremely plastic; very few fine roots; many slickensides; strongly effervescent; common coarse gypsum crystals.

Hue is 2.5Y and 5Y throughout. The A1 horizon is grayish brown, dark grayish brown, and olive gray. The soil between depths of 10 and 40 inches ranges from 40 to 60 percent clay. The B2 horizon is dark grayish brown, olive gray, and light olive brown. The C horizon is light yellowish brown, light olive brown, olive gray, and gray.

Marias soils in the Big Horn County Area have a thicker, darker colored surface layer and a higher moisture regime than typical for the series, but these differences do not alter the use or behavior of the soils.

**Marias clay, 0 to 2 percent slopes (Md).**—This soil is on fans and terraces. It has a profile similar to the one described as representative of the series, but it is non-calcareous to a depth of about 8 inches and is less sloping.

Runoff is slow, and the hazard of erosion is slight. This soil is suited to irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIs-2 dryland, IIIs-1 irrigated; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Marias clay, 2 to 4 percent slopes (Me).**—This soil is on fans and terraces. Slopes are 200 to 350 feet long. The soil has a profile similar to the one described as representative of the series, but it is less sloping.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIs-2 dryland, IIIs-3 irrigated; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Marias clay, 4 to 8 percent slopes (Mf).**—This soil is on fans and foot slopes. Areas range from 10 to 40 acres in size. Slopes are smooth and are as much as 200 feet long. The soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of soils that are noncalcareous to a depth of 12 inches, ½-acre areas of soils that have a gravelly surface layer, and some areas of Eltsac and Norbert clays.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to irrigated and dryfarmed crops, hay, watershed, wildlife, recreation, and range. Capability unit IIIs-3 dryland, IVs-1 irrigated; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Marias clay, 8 to 15 percent slopes (Mg).**—This soil is on foot slopes. It has a profile similar to the one described as representative of the series, but it is steeper.

Included with this soil in mapping are areas of soils that are calcareous to the surface, Lismas clay, Eltsac clay, and Savage silty clay loam. Surface gravel is common below gravel-capped hills.

Runoff is rapid, and the hazard of erosion is severe. Most areas receive runoff from soils above them. This soil is suited to dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IVs-2 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

## Maschetah Series

The Maschetah series consists of deep, rolling, well-drained soils on eroded terraces in bedrock uplands. Slopes range from 8 to 15 percent. These soils formed



in alluvial and eolian silt deposits. Elevation ranges from 3,500 to 4,000 feet.

The native vegetation is mainly western wheatgrass, broom snakeweed, fringed sagewort, big sagebrush, and needleandthread. Annual precipitation is 15 to 16 inches, the average annual soil temperature is 46° to 47° F, and the frost-free period is 105 to 115 days.

In a representative profile the surface layer is grayish-brown silt loam about 6 inches thick. The underlying material is light brownish-gray, light-gray, and pale-yellow silty clay loam and silt loam that extends to a depth of 65 inches or more.

Permeability is moderately slow, and available water capacity is high. The effective rooting depth is 60 inches or more. These soils are used for range, wildlife, recreation, watershed, and dryfarmed crops.

Representative profile of Maschetah silt loam, in an area of Maschetah complex, rolling, in grassland, 660 feet west and 150 feet north of the SE. corner sec. 19, T. 5 S., R. 33 E.

A11—0 to 3 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; clear, smooth boundary.

A12—3 to 6 inches, grayish-brown (10YR 5/2) heavy silt loam, very dark grayish brown (10YR 3/2) moist; weak, very fine, blocky structure; hard, friable, slightly sticky and plastic; common very fine roots; slightly effervescent; clear, wavy boundary.

C1—6 to 13 inches, light brownish-gray (2.5Y 6/2) light silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate, medium, prismatic structure parting to moderate, fine and medium, blocky; hard, friable, sticky and plastic; common very fine roots; common very fine tubular pores; strongly effervescent; few fine, soft lime masses; clear, wavy boundary.

C2ca—13 to 19 inches, light-gray (2.5Y 7/2) light silty clay loam, light olive brown (2.5Y 5/4) moist; weak, medium, prismatic structure parting to moderate, fine and medium, blocky; hard, friable, sticky and slightly plastic; common very fine roots; many very fine tubular pores; moderately effervescent; many fine and medium, soft lime masses; diffuse irregular boundary.

C3ca—19 to 30 inches, light-gray (2.5Y 7/2) heavy silt loam, light olive brown (2.5Y 5/4) moist; moderate, coarse, prismatic structure parting to weak, coarse, blocky; hard friable, sticky and slightly plastic; few very fine roots; common very fine tubular pores; violently effervescent; common fine and medium, soft lime masses; gradual, wavy boundary.

C4—30 to 43 inches, pale-yellow (2.5Y 7/4) silt loam, light olive brown (2.5Y 5/4) moist; weak, coarse, prismatic structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine tubular pores; strongly effervescent; common fine, soft lime masses; gradual, wavy boundary.

C5—43 to 65 inches, pale-yellow (2.5Y 7/4) silt loam, light olive brown (2.5Y 5/4) moist; massive; hard, friable, slightly sticky and slightly plastic; common very fine tubular pores; strongly effervescent.

The soil between depths of 10 and 40 inches is silt loam or silty clay loam. Below a depth of 10 inches, the soil ranges from 0 to 5 percent coarse fragments. Hue is 2.5Y and 10Y throughout. The A horizon ranges from 4 to 7 inches in thickness. It ranges from brown to dark grayish brown. The Cca horizon has a 20- to 30-percent calcium carbonate equivalent.

**Maschetah complex, rolling (MH).**—This complex is made up of rolling soils on dissected gravelly ter-

aces and loess-mantled hills and ridges. It is about 50 percent Maschetah silt loam and 50 percent Judith gravelly loam. Slopes range from 8 to 15 percent. The Maschetah soil is on the smoother parts of the land surface, and the Judith soil is on the edges of terraces and the sides of deep drainageways. The Maschetah soil in this complex has the profile described as representative of the Maschetah series. The Judith soil has a profile similar to the one described as representative of the Judith series, but it has a thin grayish-brown surface layer.

Runoff is rapid, and the hazard of erosion is severe. These soils are suited to range, wildlife, recreation, watershed, hay, pasture, and dryfarmed crops. Capability unit IVE-2 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 3L.

**Maschetah-Norbert complex, hilly (MK).**—This complex is made up of hilly and steep soils on dissected and eroded, gravelly and loess-mantled shale uplands. It is 40 to 70 percent Maschetah silt loam and 20 to 40 percent Norbert clay. The terrain typically consists of ridges and hills, but the soils in this complex are also in a narrow band along the gravelly rims and sides of deep valleys. Slopes are mostly 15 to 25 percent, but they range to 35 percent. In places landslides and slips form where the valley rims have collapsed. The Maschetah soil is on hills, ridges, and the upper third of the valley side slopes. The Norbert soil is on the lower part of the valley side slopes. The Maschetah and Norbert soils in this complex have profiles similar to the ones described as representative of their respective series, but a few fragments of gravel size are on the surface in places.

Included with these soils in mapping are areas of Windham gravelly loam and Xavier silty clay loam. Also included are areas of Belfield silt loam and Savage silty clay loam in wide valley on small fans.

Runoff is rapid, and the hazard of erosion is severe. These soils are suited to range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Thin Hilly range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

## Mayflower Series

The Mayflower series consists of moderately deep, strongly sloping and rolling, well-drained soils on ridges, hills, and foot slopes in the sedimentary highlands. Slopes are mostly 8 to 15 percent, but they range to 4 percent. These soils formed in clay residuum derived from shale. Elevation ranges from 5,500 to 8,000 feet.

The native vegetation is mainly rough fescue, wild geranium, horse mint, mountain brome, big sagebrush, and bedstraw. Annual precipitation is 18 to 24 inches, the average annual soil temperature is 40° to 42° F, and the frost-free period is 60 to 80 days.

In a representative profile the surface layer is dark grayish-brown silt loam about 6 inches thick. The subsoil is dark grayish-brown, brown, and reddish-brown silty clay loam and silty clay about 23 inches thick. The substratum is light reddish-brown silty clay loam.



Red sandstone and clay shale are at a depth of about 34 inches.

Permeability is slow, and available water capacity is moderate. The effective rooting depth is about 36 inches. These soils are used for range, game range, watershed, and recreation.

Representative profile of Mayflower silt loam, rolling, in grassland, 1,300 feet west and 300 north of the SE. corner sec. 17, T. 9 S., R. 32 E.

A11—0 to 2 inches, dark grayish-brown (10YR 3/2) silt loam, very dark gray (10YR 3/1) moist; weak, medium, granular structure; soft, nonsticky and slightly plastic; clear, smooth boundary.

A12—2 to 6 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, platy structure parting to weak, fine, blocky; slightly hard, friable, slightly sticky and plastic, gradual, wavy boundary.

B1—6 to 11 inches, dark grayish-brown (10YR 4/2) silty clay loam, dark brown (10YR 3/3) moist; moderate, medium and fine, blocky structure; hard, friable, sticky and plastic; clear, wavy boundary.

B21t—11 to 19 inches, brown (7.5YR 4/3) silty clay, dark brown (7.5YR 3/3) moist; strong, fine and medium, blocky structure; very hard, firm, very sticky and very plastic; thin, patchy clay films on peds; clear, wavy boundary.

B22t—19 to 29 inches, reddish-brown (5YR 5/3) silty clay, reddish brown (5YR 4/4) moist; strong, fine, blocky structure; very hard, firm, very sticky and very plastic; thin, patchy clay films on peds; clear, wavy boundary.

Cca—29 to 34 inches, light reddish-brown (5YR 6/4) silty clay loam, yellowish red (5YR 4/5) moist; weak, medium, blocky structure; hard, friable, very sticky and plastic; strongly effervescent; clear, wavy boundary.

R—34 to 51 inches, red sandstone and clay shale; common coarse lime mottles between the plates.

Depth to shale and sandstone ranges from 20 to 40 inches. The dark-colored surface layer ranges from 16 to 24 inches in thickness. The soil ranges from 0 to 20 percent coarse limestone fragments. Hue is 10YR and 7.5YR in the A horizon and 7.5YR and 5YR in the B and C horizons. The A horizon is dark grayish brown, very dark grayish brown, brown, and dark brown. The B2t horizon ranges from dark brown, brown, reddish-brown, and dark reddish-gray silty clay to heavy silty clay loam. The C horizon is light reddish brown, light brown, and reddish yellow.

**Mayflower silt loam, rolling (Mm).**—This soil is on ridges and hills in the sedimentary highlands. Slopes are smooth. They are mostly 12 to 15 percent, but they range to 8 percent. The soil has the profile described as representative of the series. Included in mapping are some areas of soils that have a surface layer of loam and scattered chert and limestone fragments on the surface.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to range, wildlife, watershed, and recreation. Capability unit IVE-2 dryland; Silty range site, 20- to 24-inch precipitation zone; windbreak suitability group 2M.

**Mayflower association, rolling (MN).**—This association is made up of Mayflower silty clay loam and Tarrete silty clay on ridges and hills in the sedimentary highlands. It is about 70 percent Mayflower silty clay loam and 30 percent Tarrete silty clay. It is typically above the limestone rims of deep canyons. Slopes are mostly 12 to 15 percent on valley sides and 8 to 12 percent on ridgetops. The Mayflower soil is on the upper sides of the hills and ridges, and the Tarrete

soil is on the lower sides. Included in mapping are small, narrow bands of Duncom channery loam along the edges of the canyons.

Runoff is medium, and the hazard of erosion is moderate. These soils are used for range, game range, watershed, and recreation. Capability unit IVE-2 dryland; Silty range site, 20- to 24-inch precipitation zone; windbreak suitability group 1.

## McKenzie Series

The McKenzie series consists of deep, nearly level, poorly drained soils in basins and depressions. Slopes range from 0 to 1 percent. These soils formed in deep clay sediment washed from fine-textured shale and mudstone. Elevation ranges from 3,200 to 4,000 feet.

The native vegetation is mainly western wheatgrass and sedges. Annual precipitation is 13 to 14 inches, the average annual soil temperature is 47° to 49° F, and the frost-free period is 110 to 125 days.

In a representative profile the surface layer is gray clay about 1 inch thick. The subsoil is gray clay about 11 inches thick. The substratum is light olive-gray and pale-olive clay that extends to a depth of 60 inches or more.

Permeability is very slow, and available water capacity is moderate or high. The effective rooting depth is 60 inches or more. These soils are used for range, wildlife, recreation, and dryfarmed crops.

Representative profile of McKenzie clay, in grassland, 2,300 feet south and 200 feet east of the NW. corner sec. 23, T. 1 S., R. 30 E.

A1—0 to 1 inch, gray (5Y 5/1) clay, olive gray (5Y 4/2) moist; strong, firm, granular structure; very hard, firm, very sticky and very plastic; common fine and very fine roots; slightly effervescent; clear, smooth boundary.

B21—1 inch to 7 inches, gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; strong, fine, granular structure; very hard, firm, very sticky and very plastic; common fine and very fine roots; slightly effervescent; gradual, wavy boundary.

B22—7 to 12 inches, gray (5Y 6/1) clay, dark gray (5Y 4/1) moist; moderate, medium and coarse, blocky structure; extremely hard, very firm, very sticky and extremely plastic; few very fine roots; common very fine pores; strongly effervescent; gradual, wavy boundary.

C1—12 to 23 inches, light olive-gray (5Y 6/2) clay, olive gray (5Y 5/2) moist; moderate, coarse structure; extremely hard, very firm, very sticky and extremely plastic; common micro pores; strongly effervescent; gradual, wavy boundary.

C2—23 to 36 inches, light olive-gray (5Y 6/2) clay, olive gray (5Y 5/2) moist; massive; extremely hard, very firm, very sticky and extremely plastic; very few very fine roots; very few very fine pores; strongly effervescent; few medium seams of gypsum crystals; clear, wavy boundary.

C3—36 to 60 inches, pale-olive (5Y 6/3) clay, olive (5Y 5/3) moist; massive; very hard, very firm, very sticky and very plastic; very few very fine pores; few medium seams and masses of gypsum crystals.

The soil ranges from clay to silty clay that is 50 to 60 percent clay. The A horizon is gray, light gray, and grayish brown. The B horizon is gray and light olive gray. The C horizon ranges from pale olive to light olive gray.

McKenzie soils in the Big Horn County Area are in a slightly warmer climate than is typical for the series, but this difference does not affect the use and behavior of the soils.

**McKenzie clay (Mo).**—This nearly level soil is in swales and depressions in rolling to hilly parts in the sedimentary uplands. Slopes are 0 to 1 percent. Areas range from 20 to 500 acres in size. The surface is ponded when the snow melts in spring and following rain early in summer.

Runoff is slow, and the hazard of erosion is slight. This soil is used for dryfarmed crops, wildlife, recreation, and range. Capability unit IIIw-2 dryland; Overflow range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

### McRae Series

The McRae series consists of deep, nearly level to steep, well-drained soils on fans, foot slopes, and eroded terraces. Slopes range from 0 to 35 percent. These soils formed in loam and clay loam alluvium. Elevation ranges from 2,800 to 3,800 feet.

The native vegetation is mainly blue grama, needle-and-thread, western wheatgrass, big sagebrush, and cheatgrass. Annual precipitation is 12 to 14 inches, the average annual soil temperature is 47° to 49° F, and the frost-free period is 115 to 125 days.

In a representative profile the surface layer is grayish-brown loam about 2 inches thick. The subsoil is grayish-brown and light yellowish-brown loam about 8 inches thick. The substratum is pale-olive and pale-yellow loam that extends to a depth of 63 inches or more.

Permeability is moderate, and available water capacity is high. The effective rooting depth is 60 inches or more. These soils are used for irrigated and dryfarmed crops, watershed, wildlife, recreation, and range.

Representative profile of McRae loam, 4 to 8 percent slopes, in grassland, 1,900 feet south and 800 feet west of the NE. corner sec. 35, T. 3 N., R. 33 E.

- A—0 to 2 inches, grayish-brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; moderate, coarse, platy structure; slightly hard, friable, nonsticky and slightly plastic; many fine and few coarse roots; clear, smooth boundary.
- B21—2 to 5 inches, grayish-brown (2.5Y 5/2) heavy loam, olive brown (2.5Y 4/4) moist; moderate, coarse and medium, prismatic structure parting to moderate, coarse, blocky; hard, friable, sticky and plastic; few fine roots; few fine pores; clear, wavy boundary.
- B22—5 to 10 inches, light yellowish-brown (2.5Y 6/4) heavy loam, light olive brown (2.5Y 5/4) moist; moderate, coarse, prismatic structure parting to moderate, coarse, blocky; hard, friable, slightly sticky and slightly plastic; few fine roots; few fine pores; strongly effervescent; few fine, soft lime masses; gradual, wavy boundary.
- C1ca—10 to 17 inches, pale-olive (5Y 6/3) heavy loam, olive (5Y 5/3) moist; weak, coarse, prismatic structure; hard, friable, sticky and plastic; few fine roots; many fine and few medium pores; strongly effervescent; few fine and medium, soft lime masses; gradual, wavy boundary.
- C2ca—17 to 24 inches, pale-yellow (5Y 7/3) heavy loam, pale olive (5Y 6/3) moist; hard, friable, sticky and plastic; massive; hard, friable, sticky and plastic; few fine roots; many fine and few medium pores; strongly effervescent; few fine and medium, soft lime masses; diffuse boundary.
- C3—24 to 63 inches, pale-yellow (5Y 7/3) loam, pale olive (5Y 6/3) moist; massive; slightly hard, friable,

slightly sticky and plastic; few fine roots; common fine pores; strongly effervescent; few fine, soft lime masses.

The soil ranges from 0 to 15 percent coarse fragments. Hue ranges from 10YR to 5Y throughout. The A horizon is grayish-brown and light brownish-gray loam or silty clay loam. The B2 horizon is grayish brown, light yellowish brown, light brownish gray, and pale brown. The Cca horizon is pale yellow, light yellowish brown, and pale olive.

**McRae loam, 0 to 1 percent slopes (Mp).**—This nearly level soil is on fans. It has a profile similar to the one described as representative of the series, but it is less sloping. Included in mapping are areas of soils that have a surface layer of silt loam.

Runoff is slow, and the hazard of erosion is slight. This soil is suited to irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIIC-1 dryland, IIC-1 irrigated; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**McRae loam, 1 to 4 percent slopes (Mr).**—This soil is in 10- to 25-acre areas on fans and foot slopes. It has a profile similar to the one described as representative of the series, but it is less sloping. Included in mapping are areas of soils that have a surface of silt loam.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIIE-3 dryland, IIE-1 irrigated; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**McRae loam, 4 to 8 percent slopes (Ms).**—This soil is on foot slopes and fans. Areas range from 15 to 50 acres in size and in places are dissected by short gullies. The soil has the profile described as representative of the series. A few surface pebbles are present where gravel terraces border the valleys. Included in mapping are areas of soils that have a surface layer of silt loam.

Runoff is medium, and the hazard of erosion is moderate. Most areas receive runoff from soils above them. This soil is suited to irrigated and dryfarmed crops, hay, watershed, wildlife, recreation, and range. Capability unit IIIE-3 dryland, IIE-1 irrigated; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**McRae silty clay loam, 0 to 1 percent slopes (Mt).**—This soil is on broad fans. It has a profile similar to the one described as representative of the series, but it is less sloping, and the surface layer is silty clay loam 8 to 12 inches thick. Where the soil is below gravel terraces, a few pebbles are on the surface.

Runoff is slow, and the hazard of erosion is slight. This soil is suited to irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIIC-1 dryland, IIC-1 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

### Midway Series

The Midway series consists of shallow, gently sloping to steep and undulating to hilly, well-drained soils in the sedimentary uplands. Slopes range from 2 to 35



percent. These soils formed in place in material weathered from silty clay loam and silty clay shale. Elevation ranges from 3,000 to 4,000 feet.

The native vegetation is side-oats grama, green needlegrass, big sagebrush, skunkbush sumac, western wheatgrass, and broom snakeweed. Annual precipitation is 12 to 14 inches, the average annual soil temperature is 47° to 49° F, and the frost-free period is 105 to 115 days.

In a representative profile the surface layer is light olive-gray silty clay loam about 2 inches thick. The underlying material is olive-gray silty clay loam that is 30 percent, by volume, shale chips in the lower part. Shale is at a depth of about 11 inches.

Permeability is slow, and available water capacity is very low. The effective rooting depth is about 15 inches. Most of these soils are used for range, recreation, wildlife, and watershed. Small areas are used for dryfarmed crops.

Representative profile of Midway silty clay loam, hilly, in grassland, 1,320 feet south and 2,000 feet east of the NW. corner sec. 30, T. 1 S., R. 30 E.

A1—0 to 2 inches, light olive-gray (5Y 6/2) light silty clay loam, olive gray (5Y 5/2) moist; strong, very fine, granular structure; hard, friable, sticky and plastic; common fine roots; slightly effervescent; clear, smooth boundary.

C1—2 to 5 inches, olive-gray (5Y 5/2) silty clay loam, olive gray (5Y 4/2) moist; moderate, thin, platy structure; hard, firm, very sticky and plastic; many fine and micro roots; many micro pores; strongly effervescent; gradual, wavy boundary.

C2—5 to 11 inches, olive-gray (5Y 5/2) channery silty clay loam, olive gray (5Y 4/2) moist; weak, coarse, blocky structure; hard, firm, very sticky and very plastic; common fine roots; common fine and micro pores; 30 percent (volume) fine, slightly weathered shale chips; strongly effervescent; diffuse, wavy boundary.

C3—11 to 14 inches, platy shale; root mats between horizontal fractures.

Depth to shale ranges from 6 to 20 inches. The soil ranges from 35 to 45 percent clay throughout. Hue is 2.5Y or 5Y throughout. The A1 horizon is light olive-brown, light olive-gray, and light brownish-gray silty clay loam, clay loam, or clay. The C horizon ranges from 5 to 35 percent, by volume, shale chips.

Midway soils in the Big Horn County Area are more olive in color (5Y hue) than is typical for the series, but this difference does not affect the use and management of the soils.

**Midway silty clay loam, undulating (Mu).**—This soil is in narrow, irregularly shaped areas on smooth ridges. Slopes range from 100 to 250 feet long. Slopes are mostly 5 to 8 percent, but they range to 2 percent. The soil has a profile similar to the one described as representative of the series, but it is less sloping.

Included with this soil in mapping are areas of Renohill silty clay loam and a few spots of soils that have a surface layer of gravelly silty clay loam.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to dryfarmed crops, pasture, wildlife, recreation, watershed, and range. Capability unit IVE-3 dryland; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 3M.

**Midway silty clay loam, rolling (MVA).**—This soil is on ridges and hills dissected by short tributary drain-

ageways. Slopes are 8 to 15 percent. The soil has a profile similar to the one described as representative of the series, but it is less sloping. Included in mapping are small areas of Heldt, Lohmiller, McRae, Thedalund, and Nelson soils.

Runoff is rapid, and the hazard of erosion is severe. This soil is suited to range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 3M.

**Midway silty clay loam, hilly (MVb).**—This soil is on deeply dissected shale uplands. Local relief ranges between 30 and 125 feet. This soil is on ridgetops, 75 to 200 feet wide, and on the upper sides of the narrow, closely spaced drainageways. Slopes range from 75 to 250 feet long. They are mostly 15 to 25 percent, but they range to 35 percent. The soil has the profile described as representative of the series.

Included with this soil in mapping are areas of Shale outcrop and small areas of Lohmiller silty clay loam. These included soils make up 10 to 35 percent of the total area of this mapping unit.

Runoff is rapid, and the hazard of erosion is severe. Geologic erosion is active on the Shale outcrop. This soil is suited to range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Thin Hilly range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

**Midway-Lismas complex, rolling (MVC).**—This complex is made up of rolling soils in the sedimentary uplands. It is about 50 percent Midway clay loam and 50 percent Lismas clay. Slopes are mostly 10 to 15 percent, but they range to 8 percent. The soils are intermixed, but the Lismas soil generally has a darker colored surface layer than the Midway soil. The Midway and Lismas soils in this complex have profiles similar to the ones described as representative of their respective series, but the Midway soil has a surface layer of clay loam, the Lismas soil has ironstone concretions scattered throughout, and both soils have a few fragments of hard sandstone on the surface. Included in mapping are areas of Thedalund loam and Kyle clay.

Runoff is rapid, and the hazard of erosion is moderate. These soils are suited to range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 3M.

**Midway-Lismas complex, hilly (MVd).**—This complex is made up of hilly and steep soils in the sedimentary uplands. It is about equal parts of Midway clay loam and Lismas clay and 10 to 30 percent Shale outcrop. Slopes are mostly 15 to 25 percent, but they range to 35 percent. The Lismas and Midway soils are intermixed, but Shale outcrop is in deep drainageways and on narrow ridges. In places a few fragments of porcelanite and red shale are scattered on the ridges. Ironstone concretions are scattered on the Shale outcrop. The Lismas soil generally is darker colored than the Midway soil. The Midway soil in this complex has a profile similar to the one described as representative of the Midway series, but the surface layer is clay loam. Included in mapping are areas of Thedalund loam, Nelson sandy loam, and Vananda clay.



Runoff is rapid, and the hazard of erosion is severe. These soils are suited to range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Thin Hilly range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

**Midway-Thedalund complex, rolling (MVe).**—This complex is made up of rolling soils in the sedimentary uplands. It is about 55 percent Midway silty clay loam, 30 percent Thedalund loam, and 15 percent Thurlow and Heldt silty clay loams. Slopes are 8 to 15 percent. The Midway and Thedalund soils are intermixed, but the Thurlow and Heldt soils are on foot slopes of wide valleys and drainageways.

Runoff is rapid, and the hazard of erosion is severe. These soils are suited to range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 3M.

**Midway-Thedalund complex, hilly (MVf).**—This complex is made up of rolling to hilly and steep soils in the sedimentary uplands. It is about 60 percent Midway silty clay loam, 25 percent Thedalund loam, and 15 percent Shale outcrop and Rock outcrop. Slopes are mostly 15 to 35 percent, but they range to 8 percent. Shale outcrop is mostly on the south and west faces of ridges and hills and along the rims of deep valleys. In places it has sandstone ledges 5 to 30 feet thick. Slopes are 8 to 10 percent on the ridgetops and 15 to 35 percent on the valley sides. North and east slopes in places have a 10- to 40-percent canopy of ponderosa pine and juniper.

Included with these soils in mapping are small areas of Cushman loam and Renohill silty clay loam on ridges and areas of Thurlow silty clay loam on narrow foot slopes in the wide valleys.

Runoff is rapid, and the hazard of erosion is severe. Runoff from the shaly areas carries large amounts of sediment. These soils are used for range, watershed, recreation, and game range. Capability unit VIe-1 dryland; Thin Hilly range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

**Midway-Thurlow association, rolling (MVg).**—This association is made up of rolling soils in the sedimentary uplands. It is about 60 percent Midway silty clay loam, 30 percent Thurlow silty clay loam, and 10 percent Renohill silty clay loam. Slopes are 8 to 15 percent. The Midway soil is on ridges and hilltops and the sides of deep drainageways. The Thurlow and Renohill soils are on the lower sides of ridges.

Runoff is medium, and the hazard of erosion is moderate. These soils are suited to watershed, wildlife, recreation, range, and pasture. Capability unit IVE-2 dryland; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 2M.

## Morton Series

The Morton series consists of moderately deep, undulating, well-drained soils in the sedimentary uplands. Slopes are mostly 4 to 8 percent, but they range to 15 percent. These soils formed in place in material weathered from silt loam and loam shale. Elevation ranges from 4,500 to 5,200 feet.

The native vegetation is mainly silver sagebrush, green needlegrass, Idaho fescue, cudweed sagewort, and western yarrow. Annual precipitation is 16 to 18 inches, the average annual soil temperature is 44° to 46° F, and the frost-free period is 90 to 105 days.

In a representative profile the surface layer is dark grayish-brown silt loam about 5 inches thick. The subsoil is dark-brown, brown, and light yellowish-brown silty clay loam about 27 inches thick. The substratum is brownish-yellow silty clay loam. Shale and sandstone are at a depth of about 38 inches.

Permeability is moderate, and available water capacity is low or moderate. The effective rooting depth is about 36 inches. These soils are used for dry-farmed crops, wildlife, recreation, watershed, and range.

Representative profile of Morton silt loam, undulating, in grassland, 875 feet west and 500 feet north of the center of sec. 35, T. 7 S., R. 37 E.

- A11—0 to 2 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate, coarse, granular structure; soft, friable, slightly sticky and slightly plastic; many fine and very fine roots; clear, smooth boundary.
- A12—2 to 5 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, medium, prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine pores; gradual, wavy boundary.
- B1—5 to 10 inches, dark-brown (10YR 4/3) light silty clay loam, dark brown (10YR 3/3) moist; moderate, medium, prismatic structure parting to strong, fine and medium, blocky; hard, friable, sticky and plastic; common very fine roots; common very fine pores; clear, wavy boundary.
- B21t—10 to 17 inches, brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) moist; strong, medium, prismatic structure parting to moderate, fine and medium, blocky; hard, friable, sticky and plastic; common very fine roots; common very fine pores; moderately thick, patchy clay films on peds; clear, wavy boundary.
- B22t—17 to 24 inches, brown (10YR 5/3) heavy silty clay loam, dark brown (10YR 4/3) moist; strong, medium, prismatic structure parting to strong, fine and medium, blocky; very hard, firm, very sticky and plastic; few very fine roots; many very fine pores; moderately thick, patchy clay films on peds; gradual, wavy boundary.
- B3—24 to 32 inches, light yellowish-brown (10YR 6/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; weak, medium, prismatic structure parting to moderate, medium, blocky; few very fine roots; many very fine pores; gradual, wavy boundary.
- C1ca—32 to 38 inches, brownish-yellow (10YR 6/6) light silty clay loam, yellowish brown (10YR 5/5) moist; massive; hard, friable, very sticky and plastic; few very fine roots; many very fine pores; strongly effervescent; diffuse, irregular boundary.
- C2—38 to 47 inches, interbedded soft shale and sandstone.

Depth to carbonates ranges from 15 to 35 inches, and depth to weakly consolidated shale and sandstone ranges from 20 to 40 inches. The A horizon is silt loam or loam that has hue of 10YR and 2.5Y. The B2t horizon is .27 to 38 percent clay. It is brown, dark brown, and yellowish brown and has chroma of 2 to 4. The C horizon ranges from 0 to 10 percent coarse fragments of shale and sandstone.

**Morton silt loam, undulating (Mw).**—This undulating and rolling soil is on ridges and hills in the sedimentary highlands. Slopes are mostly 4 to 8 percent, but they range to 15 percent. Slopes range from 200 to



500 feet long. Areas range from 40 to 350 acres in size.

Included with this soil in mapping are spots of soils that have a surface layer of channery and gravelly silt loam. Also included are areas of Regent silty clay loam.

Runoff is medium, and the hazard of erosion is moderate. In places the soil receives runoff from ridges and hills above it. This soil is suited to dry-farmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIIe-2 dryland; Silty range site, 20- to 24-inch precipitation zone; windbreak suitability group 2M.

### Nelson Series

The Nelson series consists of moderately deep, undulating and rolling, well-drained soils on hills and ridges in the sedimentary uplands. Slopes are mostly 4 to 15 percent, but they range from 2 to 20 percent. These soils formed in place in material weathered from calcareous, weakly consolidated sandstone. Elevation ranges from 3,000 to 3,800 feet.

The native vegetation is mainly prairie sandreed, dryland sedges, silver sagebrush, green sagewort, yucca, and bluebunch wheatgrass. Annual precipitation is 13 to 14 inches, the average annual soil temperature is 48 ° to 50° F, and the frost-free period is 115 to 125 days.

In a representative profile the surface layer is light olive-brown and grayish-brown fine sandy loam about 5 inches thick. The underlying material is light olive-brown, light yellowish-brown, and pale-yellow sandy loam. Sandstone is at a depth of about 29 inches.

Permeability is moderately rapid, and available water capacity is low. The effective rooting depth is about 30 inches. These soils are used for range, wildlife, watershed, recreation, and crops.

Representative profile of Nelson fine sandy loam, undulating, in grassland, 1,200 feet south and 150 feet east of the NW. corner sec. 36, T. 1 N., R. 36 E.

A—0 to 3 inches, light olive-brown (2.5Y 5/4) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; single grained; soft, very friable, nonsticky and slightly plastic; clear, smooth boundary.

AC—3 to 5 inches, grayish-brown (2.5Y 5/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; weak, coarse, prismatic structure; soft, very friable, nonsticky and slightly plastic; clear, smooth boundary.

C1—5 to 16 inches, light olive-brown (2.5Y 5/4) sandy loam, dark grayish brown (2.5Y 4/2) moist; weak, coarse, prismatic structure; slightly hard, very friable, nonsticky and slightly plastic; slightly effervescent; diffuse boundary.

C2—16 to 21 inches, light yellowish-brown (2.5Y 6/4) sandy loam, light olive brown (2.5Y 5/4) moist; massive; slightly hard, friable, nonsticky and slightly plastic; strongly effervescent; diffuse boundary.

C3—21 to 29 inches, pale-yellow (5Y 7/4) sandy loam, pale olive (5Y 6/4) moist; massive and has some evidence of platy rock structure; slightly hard, friable, nonsticky and slightly plastic; strongly effervescent; clear, wavy boundary.

C4—29 to 44 inches, pale-yellow (5Y 7/4) banded soft sandstone, pale olive (5Y 6/4) moist; strongly effervescent.

Depth to calcareous material ranges from 0 to 6 inches, and depth to sandstone and loam shale from 20 to 40 inches. The soil ranges from 0 to 15 percent coarse fragments throughout. Hue is 2.5Y or 10YR in the A and AC horizons and the upper part of the C horizon and 2.5Y or 5Y in the lower part of the C horizon.

**Nelson fine sandy loam, undulating (Nd).**—This undulating and rolling soil is on hills and ridges in the sandstone uplands. Slopes are mostly smooth, but there are a few thin ledges and outcrops of sandstone on the steep sides of prominent ridges. Slopes are mostly 4 to 8 percent, but they range from 2 to 15 percent. The soil has the profile described as representative of the series. Included in mapping are narrow 10-acre areas of Alice fine sandy loam.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to wildlife, range, pasture, watershed, and limited dryfarmed crops. Capability unit IVe-3 dryland; Sandy range site, 10- to 14-inch precipitation zone; windbreak suitability group 3M.

**Nelson-Alice fine sandy loams, rolling (Ne).**—This complex is made up of rolling soils in the sedimentary uplands. It is 40 to 60 percent Nelson fine sandy loam, 30 to 45 percent Alice fine sandy loam, and 10 percent Travessilla sandy loam and Rock outcrop. Slopes are mostly 8 to 15 percent, but they range to 20 percent. The Nelson soil is on the tops and upper sides of ridges and knolls. The Alice soil is on the narrow sides and at the heads of drainageways and on foot slopes below the Nelson soil. The Travessilla soil is around areas of Rock outcrop. The Nelson and Alice soils in this complex have profiles similar to the ones described as representative of their respective series, but they are steeper.

Runoff is medium, and the hazard of erosion is severe. These soils are suited to wildlife, watershed, range, hay, and pasture. Capability unit IVe-3 dryland; Sandy range site, 10- to 14-inch precipitation zone; windbreak suitability group 3M.

**Nelson-Glenberg sandy loams, undulating (NF).**—This complex is made up of rolling soils in the sedimentary uplands. It is 40 to 55 percent Nelson fine sandy loam, 25 to 40 percent Glenberg fine sandy loam, and 10 to 15 percent Travessilla fine sandy loam. Slopes are mostly 8 to 20 percent, but they range to 4 percent. The Nelson soil is on ridges and hills. The Travessilla soil is on ridgetops and above low sandstone ledges on hillsides. The Glenberg soil is on foot slopes of hills and ridges and in drainageways. The Nelson and Travessilla soils in this complex have profiles similar to the ones described as representative of their respective series, but they are steeper.

Runoff is medium, and the hazard of erosion is severe. These soils are suited to wildlife, watershed, range, and pasture. Capability unit IVe-3 dryland; Sandy range site. 10- to 14-inch precipitation zone; windbreak suitability group 3M.

### Neville Series

The Neville series consists of deep, undulating and rolling, well-drained soils in the sedimentary uplands. Slopes are mostly 4 to 15 percent, but they range to 2 percent. These soils formed in place in material

weathered from red shale and sandstone. Elevation ranges from 4,000 to 5,300 feet.

The native vegetation is mainly needleandthread, western wheatgrass, Hoods phlox, and big sagebrush. Annual precipitation is 11 to 13 inches, the average annual soil temperature is 47° to 49° F, and the frost-free period is 100 to 110 days.

In a representative profile the surface layer is reddish-brown loam about 2 inches thick. The underlying material is reddish-brown and light-red loam. Shale is at a depth of about 41 inches.

Permeability is moderate, and available water capacity is moderate to high. The effective rooting depth is 40 inches or more. These soils are used for range, wildlife, recreation, and watershed.

Representative profile of Neville loam, rolling, in grassland, 1,320 feet north and 1,320 feet east of the SW. corner sec. 23, T. 8 S., R. 29 E.

- A—0 to 2 inches, reddish-brown (5YR 4/3) loam, dark reddish brown (5YR 3/3) moist; moderate, medium, platy structure; slightly hard, friable, slightly sticky and slightly plastic; clear, smooth boundary.
- C1—2 to 5 inches, reddish-brown (2.5YR 5/4) heavy loam, dark reddish brown (2.5YR 3/4) moist; moderate, medium, prismatic structure; hard friable, sticky and plastic; clear, wavy boundary.
- C2—5 to 10 inches, light-red (2.5YR 6/6) heavy loam, red (2.5Y 4/6) moist; weak, medium, prismatic structure parting to weak, medium, blocky; hard, friable, sticky and plastic; strongly effervescent; gradual, wavy boundary.
- C3ca—10 to 19 inches, light-red (2.5YR 6/6) heavy loam, red (2.5YR 4/6) moist; weak, coarse, blocky structure; hard, friable, sticky and plastic; strongly effervescent; gradual, wavy boundary.
- C4—19 to 41 inches, light-red (2.5YR 6/6) heavy loam, red (2.5YR 4/6) moist; massive; hard, friable, slightly sticky and slightly plastic; strongly effervescent; diffuse boundary.
- C5—41 to 45 inches, red (2.5YR 5/6) soft shale.

Depth to calcareous material ranges from 2 to 6 inches, and depth to bedrock ranges from 40 to 60 inches. The soil ranges from 0 to 15 percent coarse fragments of shale and limestone. Between depths of 10 and 40 inches, the soil ranges from 18 to 30 percent clay. Hue ranges from 5YR to 10R throughout, and chroma, from 3 to 6. The A horizon is reddish brown and weak red. The C horizon is pale red, light red, light reddish brown, and reddish yellow.

**Neville loam, rolling (Ng).**—This rolling soil is on smooth shale and fine-grained sandstone sedimentary uplands. Slopes are mostly 8 to 15 percent, but they range to 4 percent. Areas are generally below or surrounding red shale hills and escarpments.

Included with this soil in mapping are areas of soils that are more than 40 inches deep over shale and spots of soils that have limestone fragments of gravel and channer size on the surface.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to wildlife, recreation, watershed, range, pasture, and hay. Capability unit IIIe-3 dryland; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 2M.

## Nobe Series

The Nobe series consists of deep, nearly level and gently sloping, well-drained, sodium-affected soils on fans and terraces. Slopes range from 1 to 4 percent.

These soils formed in clay alluvium. Elevation ranges from 3,400 to 4,000 feet.

The native vegetation is a sparse cover of western yarrow, six-weeks fescue, western wheatgrass, broom snakeweed, and salsify. Annual precipitation is 14 to 16 inches, the average annual soil temperature is 45° to 47° F, and the frost-free period is 105 to 115 days.

In a representative profile the surface layer is light-gray silt loam about ½ inch thick. The subsoil is olive-gray silty clay about 1 inch thick. The substratum is olive-gray and gray clay that extends to a depth of 62 inches or more.

Permeability is very slow, and available water capacity is moderate or high. The effective rooting depth is 60 inches or more. These soils are used for range, wildlife, recreation, and watershed.

Representative profile of Nobe silty clay, in grassland, 1,500 feet south and 700 feet west of the NE. corner sec. 21, T. 8 S., R. 33 E.

- A2—0 to ½ inch, light-gray (5Y 7/1) silt loam, olive gray (5Y 5/2) moist; massive; soft, friable, nonsticky and slightly plastic; many vesicular pores; abrupt, smooth boundary.
- B2t—½ inch to 1½ inches, olive-gray (5Y 5/2) light silty clay, dark olive gray (5Y 3/2) moist; moderate, fine, prismatic structure; hard, firm, sticky and plastic; common very fine roots; tops of prisms coated with unstained sand and silt grains; abrupt, smooth boundary.
- C1—1½ to 7 inches, olive-gray (5Y 5/2) light clay, dark olive gray (5Y 3/2) moist; weak, coarse, prismatic structure parting to weak, fine, blocky; very hard, very firm, very sticky and very plastic; few very fine roots; few very fine pores; slightly effervescent; clear, wavy boundary.
- C2cs—7 to 15 inches, olive-gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; moderate, fine, blocky structure; very hard, firm, very sticky and very plastic; few very fine roots; common very fine pores; many fine crystals of gypsum and other salts; strongly effervescent; few medium, soft lime masses; gradual, wavy boundary.
- C3cs—15 to 28 inches, olive-gray (5Y 5/2) clay, olive (5Y 4/2) moist; moderate, coarse, blocky structure; very hard, very firm, very sticky and very plastic; few micro pores; many fine and medium crystals of gypsum and other salts; strongly effervescent; few fine, soft lime masses; gradual, wavy boundary.
- C4cs—28 to 62 inches, gray (5Y 5/1) heavy clay, olive gray (5Y 4/2) moist; massive; extremely hard, very firm, very sticky and extremely plastic; common medium gypsum crystals; strongly effervescent.

The A2 and B2t horizons range from 1 inch to 10 inches in combined thickness. The B2t horizon is 40 to 50 percent clay. It is olive gray or grayish brown. The C and Ccs horizons range from gray to light brownish-gray clay or silty clay. The lower part of the C horizon of soils on stream terraces contains strata of clay loam and loam.

Nobe soils in the Big Horn County Area are mapped only with Absher soils.

## Norbert Series

The Norbert series consists of shallow, hilly and moderately steep, steep, and very steep, well-drained soils on dissected sedimentary uplands. Slopes range from 15 to 50 percent. These soils formed in place in material weathered from platy clay shale. Elevation ranges from 3,300 to 4,200 feet.

The native vegetation is western wheatgrass, bluebunch wheatgrass, green needlegrass, blue grama,



white locoweed, and Hoods phlox. Annual precipitation is 14 to 15 inches, the average annual soil temperature is 45° to 47° F, and the frost-free period is 95 to 115 days.

In a representative profile the surface layer is light olive-brown clay about 2 inches thick. The underlying material is light olive-brown and olive clay and channery clay. Platy shale is at a depth of about 19 inches.

Permeability is very slow, and available water capacity is very low. The effective rooting depth is about 20 inches. Most of these soils are used for range, recreation, watershed, and wildlife. A few small areas are used for dryfarmed crops.

Representative profile of Norbert clay, in an area of Norbert-Eltsac clays, hilly, in grassland, 1,980 feet south and 250 feet east of the NW. corner sec. 1, T. 8 S., R. 33 E.

A—0 to 2 inches, light olive-brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) moist; strong, very fine, granular structure; hard, firm, sticky and very plastic; clear boundary.

C1—2 to 9 inches, light olive-brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) moist; moderate, medium, granular structure; very hard, firm, very sticky and very plastic; 10 percent (volume) partly weathered shale chips; slightly effervescent; gradual, wavy boundary.

C2—9 to 19 inches, olive (5Y 5/3) channery clay, olive (5Y 4/3) moist; weak, coarse, prismatic structure; very hard, firm, very sticky and very plastic; 40 percent (volume) unweathered shale chips that are 5/2 and 5/4 dry; strongly effervescent; gradual, wavy boundary.

C3—19 to 30 inches, unweathered platy shale; few fine roots between plates.

Depth to fractured platy shale ranges from 10 to 20 inches. The soil is 50 to 60 percent clay throughout. Hue is 2.5Y to 5Y throughout. The C horizon ranges from 5 to 30 percent shale fragments.

**Norbert-Eltsac clays, hilly (NH).**—This complex is made up of hilly and moderately steep soils on dissected clay shale uplands. It is 65 to 80 percent Norbert clay and 20 to 30 percent Eltsac clay. Slopes are mostly 15 to 25 percent, but they range to 35 percent. Local relief is 60 to 150 feet. The Norbert soil in this complex has the profile described as representative of the Norbert series. It is on smooth ridges, hilltops, and side slopes. The Eltsac soil is on narrow ridges and side slopes. Included in mapping are areas of Shale outcrop at the bottoms of eroding drainageways and on points of ridges.

Runoff is rapid, and the hazard of erosion is severe. These soils are suited to range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Thin Hilly range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**Norbert-Shale outcrop complex, steep (NK).**—This complex is made up of steep and very steep soils on deeply dissected clay shale uplands. It is 40 to 65 percent Norbert clay, 25 to 40 percent Shale outcrop, and 5 to 15 percent Eltsac clay and Maginnis channery loam. Slopes are mostly 15 to 35 percent, but they range to 45 percent. Local relief is 75 to 200 feet. The ridges are narrow, and the drainageways are deep and actively eroding. Shale outcrop occurs on all parts of the terrain. The Norbert soil is on wide ridges and side slopes. Shale outcrop is on the south faces of deep

drainageways, narrow ridges, and hills. It has slopes of 45 to 75 percent.

Runoff is rapid, and the hazard of erosion is severe. Runoff water carries large amounts of sediment. These soils are suited to range, wildlife, recreation, and watershed. Capability unit VIIe-1 dryland; Shallow Clay range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

## Nunn Series

The Nunn series consists of deep, nearly level to moderately steep, well-drained soils on fans, terraces, and foot slopes in valleys along intermittent streams. Slopes range from 0 to 15 percent. These soils formed in silty clay loam alluvium. Elevation ranges from 3,300 to 3,700 feet.

The native vegetation is mainly blue grama, green needlegrass, western wheatgrass, and silver sagebrush. Annual precipitation is 14 to 15 inches, the average annual soil temperature is 47° F, and the frost-free period is 105 to 120 days.

In a representative profile the surface layer is grayish-brown silty clay loam about 8 inches thick. The subsoil is grayish-brown and light olive-brown silty clay and clay loam about 15 inches thick. The substratum is light brownish-gray, light yellowish-brown, and pale-yellow, stratified clay loam, sandy clay loam, and silt loam that extends to a depth of 60 inches or more.

Permeability is slow, and available water capacity is moderate or high. The effective rooting depth is 60 inches or more. These soils are used for dryfarmed crops, wildlife, recreation, watershed, and range. They are suitable for irrigation.

Representative profile of Nunn silty clay loam, 1 to 4 percent slopes, in a cultivated field, 1,750 feet west and 200 feet south of the NE. corner sec. 26, T. 1 N., R. 38 E.

Ap1—0 to 3 inches, grayish-brown (2.5Y 5/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; weak, coarse, blocky structure; slightly hard, friable, slightly sticky and plastic; abrupt, smooth boundary.

Ap2—3 to 8 inches, grayish-brown (2.5Y 5/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; weak, coarse, blocky structure; hard, friable, sticky and plastic; abrupt, smooth boundary.

B21t—8 to 13 inches, grayish-brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate, medium, prismatic structure parting to strong, medium, blocky; very hard, firm, very sticky and very plastic; moderately thick, patchy clay films on peds; clear, smooth boundary.

B22t—13 to 17 inches, light olive-brown (2.5Y 5/4) silty clay, olive brown (2.5Y 4/4) moist; moderate, medium, prismatic structure parting to strong, medium, blocky; very hard, firm, very sticky and very plastic; thin, patchy clay films on peds; clear, wavy boundary.

B3—17 to 23 inches, light olive-brown (2.5Y 5/4) clay loam, olive brown (2.5Y 4/4) moist; moderate, medium, subangular blocky structure; very hard, firm, sticky and very plastic; strongly effervescent; clear, wavy boundary.

C1ca—23 to 36 inches, light brownish-gray (2.5Y 6/2) clay loam, light olive brown (2.5Y 5/4) moist; massive; hard, friable, sticky and plastic; strongly effervescent; common fine lime threads and few lime masses; clear, wavy boundary.



- C2—36 to 44 inches, light yellowish-brown (2.5Y 6/4) sandy clay loam, light olive brown (2.5Y 5/4) moist; massive; hard, friable, slightly sticky and plastic; strongly effervescent; gradual, wavy boundary.
- C3—44 to 60 inches, pale-yellow (2.5Y 7/4) silt loam, light olive brown (2.5Y 5/4) moist; massive; hard, friable, nonsticky and slightly plastic; strongly effervescent.

The dark-colored surface layer ranges from 7 to 17 inches in thickness. The A and B horizons range from 12 to 23 inches in combined thickness. The soil profile typically contains less than 5 percent coarse fragments but ranges from 0 to 10 percent. The A horizon, 3 to 8 inches thick, has hue of 2.5Y or 10YR and chroma of 2 or 3. It is grayish brown, dark grayish brown, and brown. The B2t horizon is olive-brown, light olive-brown, and brown silty clay or heavy clay loam. The C horizon is light brownish gray, pale brown, light yellowish brown, and pale yellow.

**Nunn silty clay loam, 0 to 1 percent slopes (Nm).—**

This nearly level soil is on terraces. In places old channel scars make local relief of 1 foot to 2 feet. The soil has a profile similar to the one described as representative of the series, but it is less sloping. Included in mapping are spots of soils that have a water table at a depth of 5 to 6 feet and a surface layer of silt loam.

Runoff is slow, and the hazard of erosion is slight. This soil is suited to irrigated and dryfarmed crops, hay, wildlife, and range. Capability unit IIIs-3 dryland, IIs-1 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Nunn silty clay loam, 1 to 4 percent slopes (Nn).—**

This nearly level and gently sloping soil is on fans and terraces. Shallow drainageways on the fans make local relief of 1 foot to 3 feet. The soil has the profile described as representative of the series. Included in mapping are some areas of soils that have a surface layer of silt loam.

Runoff is slow, and the hazard of erosion is slight. This soil is suited to irrigated and dryfarmed crops, hay, wildlife, and range. Capability unit IIIs-2 dryland, IIs-1 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Nunn silty clay loam, 4 to 8 percent slopes (No).—**

This gently sloping soil is in 5- to 25-acre areas on fans and foot slopes. Slopes are 4 to 5 percent on the fans and 7 to 8 percent on the foot slopes. The soil has a profile similar to the one described as representative of the series, but it is steeper. Included in mapping are small areas of Midway silty clay loam.

Runoff is medium, and the hazard of erosion is moderate. Most areas on foot slopes receive runoff from soils above them. This soil is suited to irrigated and dryfarmed crops, hay, wildlife, and range. Capability unit IIIs-2 dryland, IIIs-1 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Nunn silty clay loam, 8 to 15 percent slopes (Nr).—**

This strongly sloping soil is on broad ridges that are separated by shallow tributary drainageways. Slopes are mostly 10 to 15 percent and 75 to 200 feet long. The soil has a profile similar to the one described as representative of the series, but it is steeper and in places shale is at a depth of 40 inches.

Included with this soil in mapping are areas of Midway silty clay loam on narrow ridges and the steep sides of deep drainageways.

Runoff is rapid, and the hazard of erosion is severe. This soil is suited to wildlife, range, hay, pasture, and dryfarmed crops. Capability unit IVe-3 dryland; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Nunn-Midway silty clay loams, 4 to 15 percent slopes (NS).—**This complex is made up of gently sloping and strongly sloping soils in the sedimentary uplands. It is about 55 percent Nunn silty clay loam, 25 percent Midway silty clay loam, and 20 percent small areas of Thedalund loam, Wages loam, and Wibaux channery loam. The Nunn soil is on fans and foot slopes and in valleys. It has slopes of 4 to 10 percent that range from 50 to 200 feet long. The Midway soil is on knolls and ridges. It has slopes of 10 to 15 percent. The Nunn and Midway soils in this complex have profiles similar to the ones described as representative of their respective series, but the Nunn soil is steeper, and the Midway soil is less sloping.

Runoff is medium, and the hazard of erosion is moderate. Most areas receive runoff from soils above them. These soils are suited to watershed, wildlife, range, hay, and pasture. Capability unit IVe-3 dryland; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

## Olney Series

The Olney series consists of deep, gently sloping to strongly sloping, well-drained soils on fans and at the heads of drainageways. Slopes range from 4 to 12 percent. These soils formed in sandy alluvium weathered from calcareous sandstone. Elevation ranges from 3,000 to 3,600 feet.

The native vegetation is mainly blue grama, needle-andthread, prairie sandreed, green sagewort, and fringed sagewort. Annual precipitation is 13 to 14 inches, the average annual soil temperature is 48° to 49° F, and the frost-free period is 115 to 120 days.

In a representative profile the surface layer is grayish-brown fine sandy loam about 3 inches thick. The subsoil is grayish-brown, dark grayish-brown, light yellowish-brown, and light-gray sandy loam and sandy clay loam about 34 inches thick. The substratum is light-gray and pale-yellow sandy loam that extends to a depth of 62 inches or more.

Permeability and available water capacity are moderate. The effective rooting depth is 60 inches or more. These soils are used for range, wildlife, recreation, watershed, and dryfarmed crops.

Representative profile of Olney fine sandy loam, 4 to 12 percent slopes, in grassland, 200 feet north and 300 feet east of the center of sec. 13, T. 9 S., R. 40 E.

- A—0 to 3 inches, grayish-brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak, coarse, granular structure; soft, very friable, non-sticky and slightly plastic; common fine roots; clear, smooth boundary.
- B1—3 to 6 inches, grayish-brown (10YR 5/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak, coarse, prismatic structure; slightly hard, friable, nonsticky and slightly plastic; many fine roots; clear, smooth boundary.
- B21t—6 to 13 inches, dark grayish-brown (10YR 4/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; strong, coarse, prismatic structure; hard,



firm, sticky and plastic; common fine and very fine roots; common fine and micro pores; clay bridges between sand grains; gradual, wavy boundary.

B22t—13 to 18 inches, grayish-brown (10YR 5/2) light sandy clay loam, dark brown (10YR 4/3) moist; strong, coarse, prismatic structure; hard, firm, slightly sticky and plastic; few fine roots; common fine pores; thin clay bridges between sand grains; gradual, wavy boundary.

B23t—18 to 25 inches, light yellowish-brown (2.5Y 6/4) light sandy clay loam, light olive brown (2.5Y 5/4) moist; moderate, coarse, prismatic structure; hard, friable, slightly sticky and slightly plastic; few fine roots; many very fine and micro pores; few thin clay bridges between sand grains; gradual, wavy boundary.

B3—25 to 37 inches, light-gray (2.5Y 6/2) sandy loam, light olive brown (2.5Y 5/4) moist; weak, coarse, prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few fine pores; gradual, wavy boundary.

C1—37 to 47 inches, light-gray (2.5Y 6/2) sandy loam, light olive brown (2.5Y 5/4) moist; massive; soft, friable, nonsticky and slightly plastic; few roots; slightly effervescent; clear, wavy boundary.

C2ca—47 to 62 inches, pale-yellow (2.5Y 7/4) heavy sandy loam, light yellowish brown (2.5Y 6/4) moist; massive; hard, friable, slightly sticky and plastic; strongly effervescent; soft lime masses.

Depth to calcareous material ranges from 14 to 38 inches. The A and B horizons range from 14 to 37 inches in combined thickness. The A1 horizon is grayish brown and light brownish gray in hue of 10YR or 2.5Y. The B2t horizon is grayish brown, yellowish brown, and light gray. The C horizon is light gray, pale yellow, and pale olive in hue of 2.5Y or 5Y.

#### **Olney fine sandy loam, 4 to 12 percent slopes (On).—**

This soil is on fans, terraces, and foot slopes. Slopes range from 300 to 500 feet long.

Included with this soil in mapping are areas,  $\frac{1}{2}$  to 1 acre in size, of soils that have a surface layer of loamy sand and patches, 1 acre to 2 acres in size, of Terry sandy loam. Also included are areas of soils that are calcareous at a depth of 9 inches and that have a subsoil of sandy clay loam.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to dryfarmed crops, hay, wildlife, watershed, recreation, and range. Capability unit IIIe-3 dryland; Sandy range site, 10- to 14-inch precipitation zone; windbreak suitability group 2M.

#### **Parshall Series**

The Parshall series consists of deep, gently sloping to strongly sloping and rolling, well-drained soils on foot slopes and fans and in valleys in the sandstone uplands. Slopes range from 4 to 15 percent. These soils formed in sandy loam alluvium. Elevation ranges from 3,400 to 3,800 feet.

The native vegetation is mainly prairie sandreed, little bluestem, silver sagebrush, and cudweed sage-wort. Annual precipitation is 14 to 16 inches, the average annual soil temperature is 46° to 47° F, and the frost-free period is 105 to 115 days.

In a representative profile the surface layer is grayish-brown fine sandy loam about 2 inches thick. The subsoil is grayish-brown and dark-brown sandy loam about 17 inches thick. The substratum is grayish-brown and light brownish-gray sandy loam and sandy clay loam that extends to a depth of 60 inches or more.

Permeability is moderately rapid, and available water capacity is moderate. The effective rooting depth is 60 inches or more. These soils are used for range, wildlife, recreation, watershed, and dryfarmed crops.

Representative profile of Parshall fine sandy loam, 4 to 8 percent slopes, in grassland, 1,980 feet east and 200 feet north of the SW. corner sec. 2, T. 4 S., R. 37 E.

A1—0 to 2 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak, coarse, granular structure; soft, very friable, nonsticky and slightly plastic; many very fine and fine roots; clear, smooth boundary.

B21—2 to 6 inches, grayish-brown (10YR 5/2) sandy loam, dark grayish brown (10YR 3/2) moist; weak, coarse, prismatic structure; slightly hard, friable, nonsticky and slightly plastic; common fine and very fine roots; clear, smooth boundary.

B22—6 to 19 inches, dark-brown (10YR 4/2) heavy sandy loam, very dark grayish brown (10YR 3/2) moist; moderate, coarse, prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; diffuse, smooth boundary.

C1—19 to 26 inches, grayish-brown (2.5Y 4/2) sandy loam, very dark grayish brown (2.5Y 3/2) moist; weak, coarse, prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; clear, wavy boundary.

C2—26 to 38 inches, light brownish-gray (2.5Y 6/2) sandy loam, olive brown (2.5Y 4/4) moist; massive; slightly hard, friable, nonsticky and slightly plastic; few very fine roots; few fine pores; slightly effervescent; gradual, wavy boundary.

C3—38 to 60 inches, light brownish-gray (10YR 6/2) sandy clay loam, light olive brown (2.5Y 5/4) moist; massive; hard, friable, slightly sticky and plastic; few fine roots; few fine pores; slightly effervescent; few fine, soft lime masses.

Depth to carbonates ranges from 15 to 40 inches. The dark-colored surface layer ranges from 20 to 28 inches in thickness. Between depths of 10 and 40 inches the soil ranges from 10 to 18 percent clay. The A and B horizons are grayish brown, dark grayish brown, and dark brown. The C horizon is grayish brown, light brownish gray, and light yellowish brown.

#### **Parshall fine sandy loam, 4 to 8 percent slopes (Pa).**

—This sloping soil is on foot slopes and in swales in the hilly sandstone uplands. Areas range from 15 to 25 acres in size. Slopes range from 150 to 500 feet long. Included in mapping are areas of Ascalon sandy loam.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to dryfarmed crops, hay, wildlife, watershed, recreation, and range. Capability unit IIIe-2 dryland; Sandy range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

#### **Peritsa Series**

The Peritsa series consists of moderately deep, undulating and rolling, well-drained soils on hills and ridges in the shale uplands. Slopes are mostly 4 to 15 percent, but they range to 20 percent. These soils formed in place in material weathered from red shale. Elevation ranges from 3,900 to 5,000 feet.

The native vegetation is mainly silver sagebrush, western wheatgrass, fringed sagewort, Sandberg bluegrass, and broom snakeweed. Annual precipitation is 15 to 16 inches, the average annual soil temperature



is 45° to 46° F, and the frost-free period is 90 to 110 days.

In a representative profile the surface layer is reddish-brown silt loam about 3 inches thick. The subsoil is reddish-brown and red silty clay loam about 11 inches thick. The substratum is light-red silty clay loam that contains unweathered shale chips in the lower part. Shale is at a depth of about 31 inches.

Permeability is moderate, and available water capacity is low or moderate. The effective rooting depth is 30 to 40 inches. These soils are used for range, wildlife, recreation, watershed, and dryfarmed crops.

Representative profile of Peritsa silt loam, undulating, in grassland, 300 feet north and 150 feet east of the SW. corner sec. 35, T. 6 S., R. 28 E.

- A1—0 to 3 inches, reddish-brown (5YR 4/4) silt loam, dark reddish brown (5YR 3/2) moist; moderate, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; few very fine interstitial pores; clear, smooth boundary.
- B1—3 to 6 inches, reddish-brown (5YR 4/3) silty clay loam, dark reddish brown (5YR 3/3) moist; moderate, medium, prismatic structure parting to moderate, medium, blocky; hard, friable, slightly sticky and plastic; many very fine roots; few very fine pores; clear, smooth boundary.
- B2—6 to 9 inches, reddish-brown (2.5YR 5/4) silty clay loam, dark reddish brown (2.5YR 3/4) moist; moderate, medium, prismatic structure parting to medium, coarse, blocky; hard, friable, sticky and plastic; many very fine roots; common very fine tubular pores; clear, smooth boundary.
- B3—9 to 14 inches, red (2.5YR 5/6) silty clay loam, reddish brown (2.5YR 4/4) moist; moderate, medium, prismatic structure parting to moderate, medium, blocky; hard, friable, sticky and plastic; many very fine roots; many very fine tubular pores; 2 percent fine unweathered shale chips; strongly effervescent; clear, wavy boundary.
- C1ca—14 to 24 inches, light-red (2.5YR 6/6) silty clay loam, reddish brown (2.5YR 4/4) moist; massive; very hard, firm, sticky and plastic; few fine roots; many very fine tubular pores; 2 percent fine shale chips; strongly effervescent; many fine and medium, white lime threads; gradual boundary.
- C2—24 to 31 inches, light-red (2.5YR 6/6) silty clay loam, red (2.5YR 4/6) moist; massive; very hard, firm, sticky and plastic; few very fine roots; many very fine tubular pores; 10 percent shale chips; strongly effervescent; few fine, white lime threads; gradual boundary.
- C3—31 to 38 inches, light-red (2.5YR 6/6) partly weathered shale; strongly effervescent; diffuse boundary.
- C4—38 to 68 inches, soft, red, calcareous, platy shale.

Depth to shale ranges from 20 to 40 inches. The A and B2 horizons range from 8 to 15 inches in combined thickness. Between depths of 10 and 40 inches, the soil is silty clay loam or silt loam. The A horizon is reddish brown, weak red, or reddish gray. The B2 horizon is reddish brown, pale red, or light reddish brown and pinkish gray. The Cca horizon is light red, pale red, or reddish yellow.

**Peritsa silt loam, undulating (Pd).**—This undulating soil is on hills and ridges and at the heads of drainageways. Slopes are 4 to 8 percent. This soil has the profile described as representative of the series.

Included with this soil in mapping are areas of soils that have a surface layer of channery loam. Also included are areas of Abac channery loam, Rock outcrop, and Rottulee silt loam.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to wildlife, recreation,

watershed, range, hay, and limited dryfarmed crops. Rock outcrop interferes with normal tillage. Capability unit IIIe-2 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 2M.

**Peritsa-Abac loams, rolling (PE).**—This complex is made up of rolling and moderately steep soils in the sedimentary uplands. It is about 70 percent Peritsa silt loam, 20 percent Abac loam, and 10 percent Rock outcrop. Slopes are mostly 8 to 15 percent, but they range to 20 percent. The Peritsa soil is on smooth ridges and hills and has slopes of 8 to 12 percent. The Abac soil is on narrow ridges and side slopes and has slopes of 15 to 20 percent. Rock outcrop is along drainageways and on points of ridges. The Peritsa and Abac soils in this complex have profiles similar to the ones described as representative of their respective series, but they are steeper. Included in mapping are areas of soils that have sandstone boulders covering 10 percent of the soil surface.

Runoff is rapid, and the hazard of erosion is severe. These soils are suited to wildlife, recreation, watershed, range, and pasture. Capability unit IVe-2 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**Peritsa complex, rolling (PF).**—This complex is made up of rolling soils in the sedimentary uplands. It is about 60 percent Peritsa silt loam and 40 percent Fergus and Twin Creek silt loams. Slopes are 8 to 15 percent. The Peritsa soil is at the bases of steep hills and on low ridges that slope to the valley floor. The Twin Creek soil is below the Peritsa soil and between the ridges. The Fergus soil is in valleys and on fans. It has slopes of 8 to 10 percent. The soils in this complex have profiles similar to the ones described as representative of their respective series, but they are steeper.

Runoff is medium, and the hazard of erosion is moderate. Most areas receive runoff from soils above them. These soils are suited to range, wildlife, recreation, watershed, and pasture. Capability unit IVe-2 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

## Pierre Series

The Pierre series consists of moderately deep, gently undulating to hilly and steep, well-drained soils in the sedimentary uplands. Slopes are mostly 2 to 35 percent, but they range to 1 percent. These soils formed in material weathered in place from platy clay shale. Elevation ranges from 3,000 to 3,800 feet.

The native vegetation is mainly green needlegrass, big sagebrush, western wheatgrass, white loco, curly-cup gumweed, and Hoods phlox. Annual precipitation is 13 to 14 inches, the average annual soil temperature is 47° to 49° F, and the frost-free period is 110 to 125 days.

In a representative profile the surface layer is grayish-brown silty clay and clay about 3 inches thick. The subsoil is light brownish-gray clay about 3 inches thick. The substratum is pale-olive clay. Platy clay shale is at a depth of about 29 inches.



Permeability is very slow, and available water capacity is low. The effective rooting depth is 20 to 40 inches. These soils are used for range, wildlife, recreation, watershed, and dryfarmed crops.

Representative profile of Pierre clay, rolling, in grassland, 1,320 feet north and 250 feet east of the SW. corner sec. 10, T. 1 S., R. 35 E.

- A11—0 to 1 inch, grayish-brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate, very fine, granular structure; hard, firm, sticky and very plastic; slightly effervescent; clear smooth boundary.
- A12—1 inch to 3 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak, medium, blocky structure; very hard, firm, very sticky and very plastic; common fine and medium tubular pores; slightly effervescent; clear boundary.
- B—3 to 6 inches, light brownish-gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; weak, medium, prismatic structure parting to moderate, fine, blocky; extremely hard, very firm, very sticky and very plastic; common fine and medium tubular pores; strongly effervescent; clear boundary.
- C1—6 to 17 inches, pale-olive (5Y 6/3) clay, olive (5Y 5/3) moist; weak, medium, prismatic structure parting to moderate, fine and medium, blocky; extremely hard, very firm, very sticky and very plastic; common fine and few medium tubular pores; strongly effervescent; few medium, light-gray lime masses; clear, wavy boundary.
- C2—17 to 23 inches, pale-olive (5Y 6/3) clay, olive (5Y 5/3) moist; weak, coarse, blocky structure; very hard, firm, very sticky and very plastic; indistinct slickensides; few fine and medium tubular pores; few fine clusters of gypsum crystals; strongly effervescent; gradual, wavy boundary.
- C3cs—23 to 29 inches, pale-olive (5Y 6/3) clay, olive (5Y 4/3) moist; massive; very hard, firm, very sticky and very plastic; few fine tubular pores; few fine clusters of gypsum crystals; few partly weathered shale chips; strongly effervescent; gradual, wavy boundary.
- R—29 to 41 inches, thin, platy clay shale; light olive-brown (2.5Y 5/5) iron stains along fracture planes.

Depth to shale ranges from 20 to 40 inches. Hue is 2.5Y or 5Y throughout, and chroma is 2 or 3. Between depths of 10 and 40 inches, the soil ranges from 60 to 70 percent clay. The A horizon is grayish brown, light brownish gray, and olive gray. The B horizon and the upper part of the C horizon develop ½- to 2-inch cracks when dry. The C horizon is pale olive, light olive gray, and light yellowish brown. The lower part of the C horizon is 5 to 30 percent shale chips.

**Pierre clay, undulating (Pg).**—This undulating soil is on shale hills and ridges in the sedimentary uplands. Areas range from 20 to 120 acres in size. Slopes are 4 to 5 percent on ridgetops, in swales, and at the heads of drainageways and 6 to 8 percent on the sides of deep drainageways. The soil has a profile similar to the one described as representative of the series, but it is less sloping. Included in mapping are areas of Shale outcrop and Lismas clay on the points of ridges between deep drainageways.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for dryfarmed crops, pasture, wildlife, recreation, watershed, and range. Capability unit IVe-3 dryland; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 2M.

**Pierre clay, rolling (Ph).**—This rolling soil is on hills and ridges in the shale uplands. Areas range from 20 to 200 acres in size. Slopes are 8 to 15 percent. The

soil has the profile described as representative of the series. Included in mapping are small areas of Lismas clay and Kyle clay.

Runoff is rapid, and the hazard of erosion is severe. This soil is suited to range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 2M.

**Pierre-Kyle clays, gently undulating (Pk).**—This complex is made up of gently undulating soils in the sedimentary uplands. It is about 75 percent Pierre clay and 25 percent Kyle clay. Slopes are mostly 2 to 4 percent, but they range to 1 percent. The Pierre soil is on the convex slopes of knolls and ridges. The Kyle soil is in 3- to 5-acre patches on concave slopes at the heads of drainageways and between ridges. The Kyle soil in this complex has a profile similar to the one described as representative of the Kyle series, but shale bedrock is at a depth of 40 to 50 inches.

Runoff is slow, and the hazard of erosion is moderate. These soils are suited to dryfarmed crops, pasture, wildlife, recreation, watershed, and range. Capability unit IVs-2 dryland; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 2M.

**Pierre-Lismas clays, rolling (PM).**—This complex is made up of rolling soils in the sedimentary uplands. It is about 70 percent Pierre clay, 20 percent Lismas clay, and 10 percent Kyle clay. The Pierre soil is on wide ridges, hills, and side slopes of drainageways. It has slopes of 8 to 12 percent. The Lismas soil is on narrow ridges and side slopes of deep drainageways. It has slopes of 12 to 20 percent. Included in mapping are spots of old gravelly terrace material.

Runoff is rapid, and the hazard of erosion is severe. These soils are suited to range, recreation, watershed, and wildlife. Capability unit VIe-1 dryland; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 3M.

**Pierre-Lismas clays, hilly (PN).**—This complex is made up of hilly and steep soils in the sedimentary uplands. It is 50 to 75 percent Lismas clay, 20 to 50 percent Pierre clay, and 5 to 15 percent Shale outcrop. Slopes are mostly 15 to 25 percent, but they range to 45 percent. Most areas have a narrow central ridge and spur ridges that slope steeply to the valley bottoms. Narrow drainageways separate the spur ridges. Local relief ranges from 75 to 200 feet. The Lismas soil is on steep, narrow ridges and sides of drainageways. It has slopes of 25 to 45 percent. The Pierre soil is on wide ridges and at the heads of drainageways. It has slopes of 15 to 20 percent. The Pierre and Lismas soils in this complex have profiles similar to the one described as representative of their respective series, but they are steeper. Included in mapping are spots of Harvey loam.

Runoff is rapid, and the hazard of erosion is severe. These soils are suited to range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Thin Hilly range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

## Pultney Series

The Pultney series consists of moderately deep,



undulating to very steep, well-drained soils in the sedimentary uplands. Slopes are mostly 4 to 65 percent, but they range to 2 percent. These soils formed in place in loam material weathered from calcareous, interbedded shale and sandstone. Elevation ranges from 4,000 to 5,300 feet.

The native vegetation is mainly bluebunch wheatgrass, Hoods phlox, needleandthread, and big sagebrush. Annual precipitation is 11 to 13 inches, the average annual soil temperature is 47° to 49° F, and the frost-free period is 100 to 110 days.

In a representative profile the surface layer is brown loam about 2 inches thick. The subsoil is brown loam about 4 inches thick. The substratum is light-brown loam that grades to pink loam. Shale and sandstone are at a depth of about 30 inches. A few fragments of sandstone, shale, and limestone are scattered on the surface and throughout the soil.

Permeability is moderate, and available water capacity is low. The effective rooting depth is about 30 inches. These soils are used for range, wildlife, recreation, watershed, and crops.

Representative profile of Pultney loam, in an area of Pultney-Neville association, undulating, in grassland, 1,320 feet west and 1,200 feet south of the NE corner sec. 22, T. 8 S., R. 29 E.

A1—0 to 2 inches, brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate, medium, platy structure; soft, friable, slightly sticky and slightly plastic; few fine rock chips, 1/16 to 1 inch in diameter, on surface; clear, smooth boundary.

B—2 to 6 inches, brown (7.5YR 5/3) loam, dark brown (7.5YR 4/3) moist; weak, coarse, prismatic structure; hard, friable, sticky and slightly plastic; clear, wavy boundary.

C1—6 to 12 inches, light-brown (7.5YR 6/3) loam, brown (7.5YR 5/4) moist; weak, coarse, prismatic structure; hard, friable, sticky and plastic; strongly effervescent; few fine, indistinct lime masses; gradual, wavy boundary.

C2ca—12 to 19 inches, pink (7.5YR 7/3) loam, light brown (7.5YR 6/4) moist; massive; hard, friable, sticky and plastic; violently effervescent; few fine, soft lime masses; clear, wavy boundary.

C3ca—19 to 30 inches, pink (7.5YR 8/3) loam, pink (7.5YR 7/4) moist; massive; hard, friable, slightly sticky and slightly plastic; violently effervescent; few fine, soft lime masses; few fine limestone fragments; clear, wavy boundary.

C4—30 to 52 inches, purple and pink shale and noncalcareous, white sandstone.

Depth to shale and sandstone ranges from 20 to 40 inches. The soil ranges from 0 to 15 percent coarse fragments throughout. The soil is brown, pale brown, grayish brown, and light brown in hue of 10YR or 7.5YR throughout. Between depths of 10 and 30 inches, the soil ranges from 20 to 30 percent clay. The Cca horizon is pink and very pale brown.

**Pultney-Neville association, undulating (PO).**—This association is made up of undulating soils in the sedimentary uplands. It is about 45 percent Pultney loam, 40 percent Neville loam, and 15 percent Harvey loam. Slopes are mostly 4 to 8 percent, but they range to 2 percent. The soils are intermixed, but the Neville soil can be identified by its reddish-brown surface layer. Included in mapping are areas of Travessilla sandy loam, on which sandstone is exposed at the surface.

Runoff is medium, and the hazard of erosion is moderate. These soils are suited to range, wildlife,

recreation, watershed, hay, and dryfarmed crops. Capability unit IIIe-3 dryland; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 3L.

### Quietus Series

The Quietus series consists of moderately deep, moderately steep to very steep, well-drained soils on ridges and hills in the sedimentary highlands. Slopes range from 15 to 45 percent. These soils formed in place in material weathered from dolomitic limestone. Elevation ranges from 7,000 to 8,500 feet.

The native vegetation is a mixed stand of Engelmann spruce and alpine fir and an understory of oregongrape, huckleberry, and lupine. Annual precipitation is 20 to 24 inches, the average annual soil temperature is 42° to 44° F, and the frost-free period is 60 to 70 days.

In a representative profile the surface layer is brown loam about 3 inches thick. The subsoil is brown and dark-brown loam, clay loam, and gravelly loam about 13 inches thick. The substratum is pale-brown very gravelly loam. Shattered limestone is at a depth of about 27 inches.

Permeability is moderate, and available water capacity is low. The effective rooting depth is 40 inches. These soils are used for timber production, game range, watershed, and recreation.

Representative profile of Quietus loam, in timber land, 1,320 feet west and 400 feet south of the NE corner sec. 35, T. 9 S., R. 31 E.

O—2 inches to 0, partly decomposed, matted spruce and fir needles and twigs.

A2—0 to 3 inches, brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; strong, thin, platy structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; light brownish-gray (10YR 6/2) coatings of clear sand and silt grains on peds; clear, smooth boundary.

B21t—3 to 7 inches, brown (10YR 5/3) heavy loam, dark yellowish brown (10YR 3/4) moist; weak, medium, prismatic structure parting to weak, fine, blocky; hard, friable, slightly sticky and plastic; common very fine roots; many very fine tubular pores; common clear sand and silt grains coating the larger peds; thin clay bridges between sand grains and thin clay coatings in pores; gradual, wavy boundary.

B22t—7 to 11 inches, dark-brown (10YR 4/3) heavy clay loam, dark yellowish brown (10YR 3/4) moist; weak, medium, prismatic structure parting to moderate, medium, blocky; very hard, firm, very sticky and very plastic; few very fine roots; common very fine tubular pores; very thin, continuous clay films on peds; diffuse, wavy boundary.

B23t—11 to 16 inches, brown (10YR 5/3) gravelly heavy loam, dark brown (10YR 4/3) moist; weak, fine, blocky structure; hard, friable, sticky and plastic; few very fine roots; common very fine tubular pores; thin clay bridges between sand grains and thin clay films on walls of pores; 20 percent fine limestone fragments of gravel size; gradual, wavy boundary.

C—16 to 27 inches, pale-brown (10YR 6/3) very gravelly loam, brown (10YR 5/3) moist; massive; hard, friable, slightly sticky and plastic; few very fine roots; 40 percent dolomite fragments of gravel size; abrupt, wavy boundary.

R—27 inches, shattered dolomite.

Depth to shattered limestone and dolomite ranges from 20 to 40 inches. Hue ranges from 10R to 5YR throughout.



The A horizon and the upper part of the B2 horizon range from 0 to 15 percent coarse fragments of gravel, channer, and stone size, and the lower part of the B horizon and the C horizon, from 15 to 50 percent. The A2 horizon is grayish brown and dark grayish brown. The B2t horizon is clay loam or silty clay loam. The C horizon is pale brown, light brownish gray, and grayish brown.

**Quietus loam (QU).**—This soil is on ridges and hills in the sedimentary highlands. Areas range from 40 to 300 acres in size. Slopes are smooth on the hillsides, and they are broken by limestone ledges that are 1 foot to 5 feet high. Slopes range from 15 to 45 percent, but they are 25 to 45 percent on the valley sides. Included in mapping are patches of Benteen loam.

Runoff is rapid, and the hazard of erosion is severe. This soil is suited to woodland, game range, watershed, and recreation. The principal tree species are Engelmann spruce, subalpine fir, and Douglas-fir. The average site index for the Douglas-fir is 60.

Timber harvest on this soil is not recommended because of the recreational value of the Big Horn Mountains. The high content of silt and moderate depth of the soil contribute to the severe hazard of erosion where roads are constructed. Most areas are readily accessible to fire-fighting equipment. Windthrow is a hazard on the exposed ridges and hilltops. Capability unit VIe-1 dryland; not placed in a range site or windbreak suitability group.

## Raynesford Series

The Raynesford series consists of deep, undulating, well-drained soils on fans in the sedimentary uplands. Slopes range from 4 to 8 percent. These soils formed in strongly calcareous, cobbly and gravelly alluvium derived mainly from limestone and dolomite. Elevation ranges from 5,500 to 7,500 feet.

The native vegetation is mainly green needlegrass, dryland sedges, Idaho fescue, shrubby cinquefoil, wild geranium, rough fescue, and big sage. Annual precipitation is 18 to 20 inches, the average annual soil temperature is 43° to 45° F, and the frost-free period is 60 to 75 days.

In a representative profile the surface layer is dark-brown loam and clay loam about 10 inches thick. The subsoil is pale-brown gravelly clay loam about 11 inches thick. The substratum is very pale brown gravelly clay loam, very gravelly clay loam, and very gravelly loam that is 30 to 60 percent limestone fragments of gravel and cobble size.

Permeability is moderately slow, and available water capacity is moderate. The effective rooting depth is 60 inches or more. These soils are used for range, wildlife, recreation, and watershed.

Representative profile of Raynesford loam, undulating, in grassland, 1,320 feet south and 600 feet west of the NE. corner sec. 6, T. 9 S., R. 32 E.

A11—0 to 4 inches, dark-brown (10YR 3/3) loam, very dark brown (10YR 2/3) moist; moderate, very coarse, granular structure; soft, friable, slightly sticky and slightly plastic; common very fine and micro roots; 10 percent (volume) limestone and chert fragments of gravel size; clear, smooth boundary.

A12—4 to 10 inches, dark-brown (10YR 4/3) light clay loam, dark brown (10YR 3/3) moist; moderate, fine, blocky structure; hard, friable, sticky and

plastic; common very fine and micro roots; 10 percent (volume) limestone and chert fragments of gravel size; clear, wavy boundary.

B21—10 to 15 inches, pale-brown (10YR 6/3) gravelly light clay loam, brown (10YR 5/3) moist; weak, medium, prismatic structure parting to moderate, fine, blocky; very hard, firm, very sticky and plastic; few very fine and micro roots; common micro pores; 20 percent (volume) limestone fragments of gravel size; gradual, wavy boundary.

B22—15 to 21 inches, pale-brown (10YR 6/3) gravelly light clay loam, brown (10YR 5/3) moist; weak, fine, blocky structure; very hard, firm, very sticky and plastic; few micro roots; 20 percent (volume) limestone fragments of gravel size; slightly effervescent; clear, wavy boundary.

C1ca—21 to 30 inches, very pale brown (10YR 7/3) gravelly clay loam, pale brown (10YR 6/3) moist; massive; very hard, firm, very sticky and plastic; 30 percent (volume) limestone fragments of gravel size; strongly effervescent; lime coating on gravel; gradual, wavy boundary.

C2ca—30 to 41 inches, very pale brown (10YR 8/3) very gravelly heavy loam, very pale brown (10YR 7/3) moist; massive; hard, firm, sticky and plastic; 50 percent (volume) limestone fragments of gravel size; violently effervescent; lime coatings on gravel; diffuse, wavy boundary.

C3—41 to 49 inches, very pale brown (10YR 8/3) very gravelly clay loam, very pale brown (10YR 7/3) moist; massive; hard, friable, sticky and plastic; 60 percent (volume) limestone fragments of gravel and cobble size; violently effervescent; lime coatings on gravel and cobbles.

Depth to calcareous material ranges from 6 to 12 inches. The soil between depths of 10 and 40 inches is heavy loam or clay loam. Above a depth of 30 inches, the soil ranges from 5 to 35 percent coarse fragments of limestone, chert, and shale. Hue is 10YR or 7.5YR throughout. The dark-colored surface layer ranges from 8 to 12 inches in thickness. The A1 horizon is dark brown, very dark grayish brown, and dark grayish brown. The Cca horizon is pink and very pale brown.

**Raynesford loam, undulating (Ra).**—This gently sloping and undulating soil is on wide ridges and hills in the sedimentary uplands. Slopes are 4 to 8 percent. Shallow drainageways make a local relief of 5 to 15 feet. Slopes range from 200 to 500 feet long. Included in mapping are areas of Duncom stony loam that have 20 to 35 percent coarse fragments on the surface.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to wildlife, recreation, watershed, range, and pasture. Capability unit IVE-2 dryland; Silty range site, 20- to 24-inch precipitation zone; windbreak suitability group 2L.

## Reeder Series

The Reeder series consists of moderately deep, undulating to hilly, well-drained soils on hills and ridges in the sedimentary uplands. Slopes range from 2 to 25 percent. These soils formed in place in material weathered from mixed shale and sandstone. Elevation ranges from 3,500 to 6,000 feet.

The native vegetation is mainly Idaho fescue, prairie junegrass, Indian paintbrush, Hoods phlox, lupine, and big sagebrush. Annual precipitation is 14 to 16 inches, the average annual soil temperature is 44° to 47° F, and the frost-free period is 90 to 110 days.

In a representative profile the surface layer is dark grayish-brown loam about 4 inches thick. The subsoil is dark grayish-brown and brown loam and clay loam



about 17 inches thick. The substratum is pale-brown clay loam and loam. Sandy shale and sandstone are at a depth of about 30 inches.

Permeability is moderate, and available water capacity is low. The effective rooting depth is about 30 inches. These soils are used for range, wildlife, recreation, watershed, and dryfarmed crops.

Representative profile of Reeder loam, undulating, in grassland, 2,640 feet south and 1,320 feet west of the NE. corner sec. 26, T. 6 S., R. 29 E.

- A1—0 to 4 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak, coarse, platy structure parting to weak, coarse, granular; soft, very friable, slightly sticky and slightly plastic; clear boundary.
- B1—4 to 8 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak, medium, prismatic structure parting to weak, medium, subangular blocky; slightly hard, friable, slightly sticky and plastic; clear, wavy boundary.
- B21t—8 to 13 inches, brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; moderate, medium, prismatic structure parting to moderate medium, blocky; hard, friable, sticky and plastic; thin, patchy clay films on ped; dark grayish-brown (10YR 4/2) organic stains on vertical surfaces of ped; gradual, wavy boundary.
- B22t—13 to 21 inches, brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate, medium, prismatic structure parting to moderate, medium, blocky; hard, friable, sticky and plastic; thin, patchy clay films on ped; gradual, wavy boundary.
- C1—21 to 25 inches, pale-brown (10YR 6/3) clay loam, dark brown (10YR 4/3) moist; weak, medium, blocky structure; hard, friable, sticky and plastic; clear, wavy boundary.
- C2—25 to 30 inches, pale-brown (10YR 6/3) loam, light yellowish brown (10YR 6/4) moist; massive; hard, friable, slightly sticky and slightly plastic; strongly effervescent; abrupt, wavy boundary.
- C3—30 to 36 inches, sandy shale and sandstone.

Depth to carbonates ranges from 10 to 26 inches, and depth to fine-grained sandstone and shale, from 20 to 40 inches. The soil ranges from 0 to 15 percent coarse fragments throughout. The dark-colored surface layer ranges from 8 to 12 inches in thickness. The A1 horizon is loam or silt loam. It is dark grayish brown, grayish brown, and brown in hue of 10YR or 7.5YR. The B2t horizon ranges from 22 to 35 percent clay. It is brown, grayish brown, and light olive brown in hue of 10YR or 2.5Y. The C horizon is pale brown, light gray, and light brownish gray.

**Reeder loam, gently undulating (Rda).**—This gently undulating soil is on broad ridges in the sedimentary uplands. Slopes are 2 to 4 percent. The soil has a profile similar to the one described as representative of the series, but it is less sloping. Included in mapping are patches of Rentsac gravelly loam and Farnuf loam.

Runoff is slow, and the hazard of erosion is slight. This soil is used for dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIe-2 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 2M.

**Reeder loam, undulating (Rdb).**—This undulating soil is on broad ridges between major drainageways in the sedimentary uplands. Slopes are mostly 4 to 8 percent. The ridges are 175 to 250 feet wide, and side slopes are 200 to 300 feet long. Shallow drainageways make local relief of 25 to 30 feet. In places ledges of hard sandstone, 1 foot to 2 feet high, crop out on steep hillsides. The soil has the profile described as

representative of the series. Included in mapping are narrow areas of Farnuf loam and Arnegard loam.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIIe-2 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 2M.

**Reeder loam, hilly (Rdc).**—This hilly soil is on the sides of long ridges in the sedimentary uplands. Slopes are mostly 15 to 25 percent, but they range to 35 percent. They range from 150 to 300 feet long. The soil has a profile similar to the one described as representative of the series, but it is steeper. Included in mapping are areas of Arnegard loam and Lap channery loam.

Runoff is rapid, and the hazard of erosion is severe. This soil is suited to range, watershed, recreation, and wildlife. Capability unit VIe-1 dryland; Thin Hilly range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**Reeder-Regent complex, rolling (REa).**—This complex is made up of rolling soils on ridges and hills in the sedimentary uplands. It is about 40 percent Reeder loam, 30 percent Regent silty clay loam, and 30 percent Doney, Rentsac, and Amherst soils and Rock outcrop. Slopes are mostly 8 to 15 percent, but they range to 4 percent. The Reeder and Regent soils are intermixed on smooth ridges and knolls above sandstone ledges.

Runoff is medium, and the hazard of erosion is moderate. These soils are suited to wildlife, recreation, watershed, range, hay, and limited dryfarmed crops. Because of the Rock outcrop, fields are irregularly shaped. Capability unit IVe-2 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 2M.

**Reeder-Rentsac complex, undulating (REb).**—This complex is made up of undulating soils on ridges and hills in the sedimentary uplands. It is about 35 percent Reeder loam, 25 percent Rentsac loam, 25 percent Doney loam, and 15 percent Regent, Amherst, and Wayden soils. Slopes are 4 to 8 percent. The Reeder soil is on the smooth sides of shallow drainageways and in troughs between low ridges. The Rentsac and Doney soils are on crests of ridges and along sharp narrow breaks. Included in mapping are areas of soils that have surface channers and low ledges of Rock outcrop.

Runoff is medium, and the hazard of erosion is moderate. These soils are suited to range, wildlife, recreation, and watershed. Capability unit VIIs-1 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 3M.

**Reeder-Darret association, undulating (REc).**—This association is made up of undulating soils on ridges and hills in the sedimentary uplands. It is about equal parts of Reeder loam and Darret silty clay loam and some small spots of Castner stony loam. Slopes are 4 to 8 percent. The soils are intermixed. The Darret soil in this complex has the profile described as representative of the Darret series. In places the Reeder and Darret soils are 5 to 15 percent chert, flint, and silica fragments of gravel size.



Runoff is medium, and the hazard of erosion is moderate. These soils are suited to wildlife, recreation, watershed, range, and hay. Capability unit IIIe-2 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 2M.

**Reeder-Darret association, rolling (RED).**—This association is made up of rolling soils on ridges and hills in the sedimentary uplands. It is about 45 percent each Reeder loam and Darret silty clay loam and 10 percent Castner stony loam. Slopes are 8 to 15 percent. The Reeder and Darret soils are intermixed. In places they are 5 to 15 percent chert, flint, and silica fragments of gravel size.

Runoff is medium, and the hazard of erosion is moderate. These soils are suited to wildlife, recreation, watershed, range, and pasture. Capability unit IVe-2 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 2M.

### Regent Series

The Regent series consists of moderately deep, undulating to hilly and steep, well-drained soils on hills and ridges in the sedimentary uplands. Slopes range from 2 to 35 percent. These soils formed in place in material weathered from clay shale. Elevation ranges from 3,400 to 5,000 feet.

The native vegetation is mainly western wheatgrass, Idaho fescue, timber dantonion, rubber rabbitbrush, and slender wheatgrass. Annual precipitation is 14 to 16 inches, the average annual soil temperature is 44° to 47° F, and the frost-free period is 90 to 110 days.

In a representative profile the surface layer is grayish-brown silty clay loam about 3 inches thick. The subsoil is grayish-brown and pale-olive silty clay loam about 13 inches thick. The substratum is light-gray silty clay loam. Platy shale is at a depth of about 26 inches.

Permeability is slow, and available water capacity is low or moderate. The effective rooting depth is about 26 inches. These soils are used for dryfarmed crops, wildlife, recreation, watershed, and range.

Representative profile of Regent silty clay loam, undulating, in grassland, 1,320 feet west and 1,320 feet north of the SE. corner sec. 2, T. 7 S., R. 39 E.

- A1—0 to 3 inches, grayish-brown (2.5Y 5/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; strong, fine, platy structure parting to strong, fine, granular; hard, friable, slightly sticky and plastic; clear, smooth boundary.
- B2t—3 to 11 inches, grayish-brown (2.5Y 5/2) heavy silty clay loam, very dark grayish brown (2.5Y 3/2) moist; weak, medium, prismatic structure parting to moderate, fine, blocky; hard, friable, sticky and very plastic; thin, patchy clay films on ped; clear boundary.
- B3—11 to 16 inches, pale-olive (5Y 6/3) silty clay loam, olive (5Y 5/3) moist; weak, fine, blocky structure; very hard, firm, sticky and plastic; moderately thick, patchy clay films on ped; strongly effervescent; clear boundary.
- C1ca—16 to 26 inches, light-gray (5Y 7/2) silty clay loam, olive (5Y 5/3) moist; massive; very hard, firm, sticky and plastic; strongly effervescent; clear, wavy boundary.
- C2—26 to 33 inches, pale-yellow (5Y 7/3) fine platy shale, pale olive (5Y 6/3) moist.

Depth to calcareous material ranges from 6 to 17 inches, and depth to shale, from 20 to 40 inches. The A horizon is light brownish gray, grayish brown, and dark grayish brown in hue of 2.5Y or 10YR. It is silty clay loam, clay loam, or silty clay. The B2t horizon is 35 to 45 percent clay. It is grayish brown, light olive brown, and pale olive. The B3ca and Cca horizons are light yellowish brown, pale olive, and light gray.

**Regent silty clay loam, gently undulating (Rfa).**—This gently undulating soil is on broad ridges in the shale uplands. Slopes are 2 to 4 percent. They range from 150 to 300 feet long. Areas range from 10 to 40 acres in size. The soil has a profile similar to the one described as representative of the series, but it is less sloping.

Runoff is slow, and the hazard of erosion is slight. This soil is suited to dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIe-2 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 2M.

**Regent silty clay loam, undulating (Rfc).**—This undulating soil is in 20- to 80-acre areas on hills and ridges and in shallow drainageways in the shale uplands. Slopes are 4 to 8 percent. The soil has the profile described as representative of the series. Included in mapping are areas of Wayden silty clay loam.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIIe-2 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 2M.

**Regent silty clay loam, rolling (Rfd).**—This rolling soil is on hills and ridges in the shale uplands. Slopes are 8 to 15 percent. Areas range from 30 to 200 acres in size. The soil has a profile similar to the one described as representative of the series, but it is steeper.

Included with this soil in mapping are areas of Wayden silty clay loam that make up as much as 30 percent of the total area of this mapping unit. Also included are areas of Cherry and Savage soils.

Runoff is rapid, and the hazard of erosion is severe. This soil is suited to recreation, wildlife, watershed, hay, pasture, and limited dryfarmed crops. Capability unit IVe-2 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 2M.

### Renohill Series

The Renohill series consists of moderately deep, undulating, well-drained soils on ridges and hills in the sedimentary uplands. Slopes range from 4 to 8 percent. These soils formed in place in material weathered from calcareous clay loam and silty clay loam shale. Elevation ranges from 3,100 to 4,000 feet.

The native vegetation is mainly western wheatgrass, broom snakeweed, cheatgrass brome, green needlegrass, rubber rabbitbrush, and big sagebrush. Annual precipitation is 13 to 14 inches, the average annual soil temperature is 47° to 49° F, and the frost-free period is 105 to 115 days.

In a representative profile the surface layer is light brownish-gray silty clay loam about 2 inches thick. The subsoil is grayish-brown, brown, and light olive-brown silty clay loam and silty clay about 11 inches thick. The substratum is light brownish-gray and



pale-olive silty clay loam, silty clay, and clay that contains a few shale chips in the lower part. Clay shale is at a depth of about 33 inches.

Permeability is slow, and available water capacity is low. The effective rooting depth is about 33 inches. These soils are used for range, wildlife, recreation, watershed, and dryfarmed crops.

Representative profile of Renohill silty clay loam, undulating, in grassland, 1,000 feet north and 200 feet east of the center of sec. 21, T. 4 S., R. 29 E.

- A1—0 to 2 inches, light brownish-gray (10YR 6/2) light silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate, thin, platy structure; slightly hard, friable, slightly sticky and plastic; clear, smooth boundary.
- B1—2 to 4 inches, grayish-brown (10YR 5/2) light silty clay loam, dark brown (10YR 3/3) moist; moderate, medium, platy structure; hard, friable, sticky and plastic; clear, smooth boundary.
- B2t—4 to 10 inches, brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; moderate, medium, prismatic structure parting to moderate, medium, blocky; very hard, firm, very sticky and very plastic; patchy, moderately thick clay films on peds; clear, wavy boundary.
- B3—10 to 13 inches, light olive-brown (2.5Y 5/4) heavy silty clay loam, olive brown (2.5Y 4/4) moist; moderate, medium, prismatic structure parting to moderate, medium, blocky; very hard, firm, very sticky and very plastic; slightly effervescent; few medium masses of lime; clear, wavy boundary.
- C1ca—13 to 21 inches, light brownish-gray (2.5Y 6/2) heavy silty clay loam, olive brown (2.5Y 4/4) moist; weak, medium, prismatic structure parting to weak, medium, blocky; very hard, firm, sticky and plastic; strongly effervescent; common medium and coarse lime masses; gradual, wavy boundary.
- C2ca—21 to 26 inches, light brownish-gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate, medium, subangular blocky structure; very hard, very firm, very sticky and plastic; strongly effervescent; common coarse lime masses; gradual, wavy boundary.
- C3ca—26 to 33 inches, pale-olive (5Y 6/3) clay, olive (5Y 4/3) moist; massive; very hard, very firm, very sticky and very plastic; common weathered shale chips; strongly effervescent; common very coarse lime masses; gradual, wavy boundary.
- C4—33 to 41 inches, thin, platy clay shale.

Depth to calcareous material ranges from 9 to 15 inches, and depth to bedrock, from 20 to 40 inches. The A1 and B2t horizons are light brownish gray, grayish brown, brown, and light olive brown in hue of 2.5Y and 10YR. The Cca horizon is light brownish gray, pale olive, and light yellowish brown in hue of 2.5Y and 5Y.

**Renohill silty clay loam, undulating (Re).**—This soil is on broad ridgetops and tablelands that are crossed by shallow drainageways. Slopes are 4 to 8 percent. Areas range from 20 to 50 acres in size.

Included with this soil in mapping are areas of Midway silty clay loam on narrow ridges and Thurlow silty clay loam and Heldt silty clay loam in the concave heads of drainageways. Also included are soils that have a few fragments of pebble size on the surface in areas where terraces once covered the shale upland.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIIe-3 dryland; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 2M.

## Rentsac Series

The Rentsac series consists of shallow, undulating and rolling, well-drained soils on ridges and hills in the sedimentary uplands. Slopes range from 4 to 15 percent. These soils formed in place in material weathered from calcareous, hard, fine-grained shale and sandstone. Elevation ranges from 3,700 to 4,800 feet.

The native vegetation is mainly side-oats grama, prairie junegrass, bluebunch wheatgrass, dryland sedges, broom snakeweed, and wild rose. Annual precipitation is 10 to 15 inches, the average annual soil temperature is 46° to 47° F, and the frost-free period is 105 to 110 days.

In a representative profile the surface layer is light brownish-gray and grayish-brown loam about 4 inches thick. The underlying material is light brownish-gray channery loam. Hard sandy shale is at a depth of about 8 inches.

Permeability is moderately rapid, and available water capacity is very low. The effective rooting depth is 10 inches. Most of these soils are used for range, wildlife, recreation, and watershed, but small areas included with deeper soils are used for dryfarmed crops.

Representative profile of Rentsac loam, in an area of Rentsac-Doney complex, rolling, in grassland, 990 feet north and 350 feet east of the SE. corner sec. 35, T. 7 S., R. 39 E.

- A11—0 to 1 inch, light brownish-gray (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak, coarse, granular structure; soft, very friable, non-sticky and nonplastic; few small sandstone chips; slightly effervescent; clear boundary.
- A12—1 inch to 4 inches, grayish-brown (10YR 5/2) loam, dark brown (10YR 3/3) moist; weak, medium, prismatic structure; slightly hard, friable, non-sticky and slightly plastic; about 5 percent (volume) flat, hard sandstone chips; strongly effervescent; gradual boundary.
- C—4 to 8 inches, light brownish-gray (10YR 6/2) channery loam, dark brown (10YR 3/3) moist; weak, medium, subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; 40 percent (volume) thin, hard sandstone fragments, 1/16 to 1/4 inch in diameter; strongly effervescent; abrupt, wavy boundary.
- R—8 to 10 inches, hard sandy shale.

Depth to shale and sandstone bedrock ranges from 4 to 20 inches. The soil is sandy loam or loam that is 15 to 60 percent, but typically 35 to 50 percent, coarse fragments of channer and gravel size. Hue ranges from 2.5Y to 7.5YR throughout. The A1 horizon is brown, light brownish gray, light brown, grayish brown, and pale brown. The C horizon is light brownish gray, light yellowish brown, pale brown, and very pale brown.

**Rentsac-Doney complex, rolling (RH).**—This complex is made up of rolling soils on hills and narrow ridges in the mixed shale and hard sandstone uplands. It is about 45 percent Rentsac loam and Rentsac channery loam, 30 percent Doney loam, and 25 percent Wayden silty clay loam, Dast sandy loam, and Rock outcrop. Slopes are 8 to 15 percent. Local relief is 30 to 125 feet. The soils are intermixed. Rock outcrop occurs as low ledges along drainageways and is scattered in areas of the Rentsac soil. The Rentsac loam in this



complex has the profile described as representative of the Rentsac series.

Runoff is rapid, and the hazard of erosion is severe. These soils are suited to range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Shallow range site, 15- to 19-inch precipitation zone; windbreak suitability group 3M.

### Richfield Series

The Richfield series consists of deep, nearly level to undulating, well-drained soils on high benches and hills and ridges. Slopes range from 0 to 8 percent. These soils formed in silt loam and silty clay loam alluvium transported by water and wind. Elevation ranges from 3,100 to 3,600 feet.

The native vegetation is mainly western wheatgrass, prairie junegrass, big sage, plains reedgrass, and winterfat. Annual precipitation is 14 to 15 inches, the average annual soil temperature is 47° to 49° F, and the frost-free period is 110 to 120 days.

In a representative profile the surface layer is grayish-brown silty clay loam about 9 inches thick. The subsoil is brown and light yellowish-brown silty clay loam about 10 inches thick. The substratum is light brownish-gray and light olive-gray silt loam and loam that extends to a depth of 65 inches or more.

Permeability is moderately slow, and available water capacity is high. The effective rooting depth is 60 inches or more. These soils are used for dryfarmed crops, watershed, recreation, wildlife, and range. They are suitable for irrigation.

Representative profile of Richfield silty clay loam, 0 to 2 percent slopes, in a cultivated area, 660 feet north and 300 feet east of the SW. corner sec. 10, T. 2 S., R. 34 E.

- Ap1—0 to 7 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak, very fine, granular structure; hard, friable, sticky and slightly plastic; few fine roots; clear, smooth boundary.
- Ap2—7 to 9 inches, grayish-brown (10YR 5/2) heavy silty clay loam, dark brown (10YR 3/2) moist; weak, coarse, blocky structure; hard, friable, slightly sticky and plastic; few very fine roots; abrupt, smooth boundary.
- B2t—9 to 13 inches, brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; moderate, medium, prismatic structure parting to moderate, medium, blocky; hard, friable, sticky and plastic; few very fine roots; common very fine pores; thin, patchy clay films on peds; clear, wavy boundary.
- B3—13 to 19 inches, light yellowish-brown (2.5Y 6/4) silty clay loam, olive brown (2.5Y 4/4) moist; weak, medium, prismatic structure parting to weak, medium, blocky; hard, friable, sticky and plastic; few very fine roots; many very fine pores; slightly effervescent; few fine, soft lime masses; gradual, wavy boundary.
- C1ca—19 to 26 inches, light brownish-gray (2.5Y 6/2) heavy silt loam, grayish brown (2.5Y 5/2) moist; weak, coarse, prismatic structure parting to weak, coarse, blocky; hard, friable, sticky and slightly plastic; few very fine roots; common very fine pores; strongly effervescent; common fine lime threads and soft lime masses; diffuse, wavy boundary.
- C2ca—26 to 37 inches, light brownish-gray (2.5Y 6/2) silt loam, grayish brown (2.5Y 5/2) moist; weak, coarse, prismatic structure; hard, friable, sticky

and slightly plastic; common very fine pores; strongly effervescent; common fine, soft lime masses; diffuse, wavy boundary.

- C3—37 to 65 inches, light olive-gray (5Y 6/2) loam, olive (5Y 4/4) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine pores; strongly effervescent; few fine, soft lime masses.

The A and B horizons range from 9 to 18 inches in thickness. Depth to carbonates ranges from 10 to 16 inches. The A1 horizon is grayish-brown and brown silt loam or light silty clay loam. It ranges from 2 to 4 inches in thickness. The B2t horizon is 35 to 45 percent clay, and it ranges from 7 to 14 inches in thickness. It is brown and grayish brown. The Cca horizon is light brownish gray, light gray, and light yellowish brown.

#### Richfield silty clay loam, 0 to 2 percent slopes (Rk).

—This nearly level soil is on benches and shale uplands that are mantled with silt loam and silty clay loam alluvium. It has the profile described as representative of the series. Included in mapping are small areas of Hydro silt loam and Allentine silty clay.

Runoff is slow, and the hazard of erosion is slight. This soil is suited to irrigated and dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIIc-1 dryland, IIc-2 irrigated; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

#### Richfield silty clay loam, gently undulating (Rlc).—

This soil is in 15- to 100-acre areas on benches and shale uplands that are mantled with silt loam and silty clay loam alluvium. Slopes are 2 to 4 percent and are 100 to 300 feet long. Drainageways are shallow, and total relief is only 10 to 30 feet. The soil has a profile similar to the one described as representative of the series, but it is steeper. Included in mapping are areas of Hydro silt loam.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to irrigated and dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIIe-3 dryland, IIe-1 irrigated; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Richfield silty clay loam, undulating (Rld).—**This soil is on benches and shale uplands that are mantled with silt loam and silty clay loam alluvium. Slopes are 4 to 8 percent. Drainageways are 8 to 25 feet deep. The soil has a profile similar to the one described as representative of the series, but it is steeper.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to irrigated and dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIIe-3 dryland, IIIe-1 irrigated; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Richfield-Beauvais silty clay loams, gently undulating (Rle).—**This complex is made up of gently undulating soils on high terraces and shale uplands that are mantled with silt loam and silty clay loam alluvium. It is about 60 percent Richfield silty clay loam, 30 percent Beauvais silty clay loam, and 10 percent Hydro loam. The soils are on low knolls separated by swales. The Richfield silty clay loam is in the swales and the concave surfaces. It has slopes of 2 percent. The Beauvais soil is on the knolls and crests of undulations. It has slopes of 3 to 4 percent. The Hydro soil is in level areas.



Runoff is slow, and the hazard of erosion is slight. These soils are suited to irrigated and dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIIe-3 dryland, IIe-1 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Richfield-Beauvais silty clay loams, undulating (Rlf).**—This complex is made up of undulating soils on terraces and shale uplands that are mantled with silt loam and silty clay loam alluvium. It is about 55 percent Richfield silty clay loam, 35 percent Beauvais silty clay loam, and 10 percent Colby silt loam. Slopes are 4 to 8 percent. Main drainageways at terrace edges or between the mantled ridges make local relief of 15 to 30 feet. The Richfield soil has smooth slopes of 4 to 5 percent and is between knolls and ridges of the Beauvais soil. The Colby soil has slopes of 7 to 8 percent and is along the short terrace slope breaks and on narrow ridgetops. The Richfield and Beauvais soils in this complex have profiles similar to the ones described as representative of their respective series, but they are steeper.

Runoff is medium, and the hazard of erosion is moderate. These soils are used for irrigated and dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIIe-3 dryland, IIIe-1 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

### Ringling Series

The Ringling series consists of shallow, rolling to very steep, well-drained soils in the sedimentary uplands. Slopes range from 8 to 95 percent. These soils formed in place in material weathered from hard, red, baked shale or porcelanite rock. Elevation ranges from 3,400 to 5,000 feet.

The native vegetation is mainly bluebunch wheatgrass, Idaho fescue, Sandberg bluegrass, and ponderosa pine. Annual precipitation is 14 to 16 inches, the average annual soil temperature is 45° to 47° F, and the frost-free period is 90 to 105 days.

In a representative profile the surface layer is reddish-brown channery loam about 3 inches thick. The underlying material is reddish-brown very channery loam that is 35 to 80 percent coarse fragments. Hard, platy shale is at a depth of about 13 inches.

Permeability is rapid, and available water capacity is very low. The effective rooting depth is about 15 inches. These soils are used only for range.

Representative profile of Ringling channery loam, in an area of Doney-Ringling complex, rolling, in grassland, 2,000 feet west and 2,300 feet north of the SW corner sec. 17, T. 5 S., R. 38 E.

A1—0 to 3 inches, reddish-brown (5YR 4/4) channery loam, dark reddish brown (5YR 3/3) moist; weak, fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; many very fine interstitial pores; 30 percent thin, hard shale fragments; clear, wavy boundary.

C1—3 to 13 inches, reddish-brown (5YR 5/3) very channery loam, dark reddish brown (5YR 3/4) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine roots; 35 percent, increasing to 80 percent, hard shale fragments; abrupt, irregular boundary.

C2—13 to 60 inches, hard, platy, red, baked shale coated with lime; coatings of lime along bedding planes.

Depth to fractured bedrock ranges from 5 to 20 inches. The soil ranges from 45 to 60 percent coarse fragments. Lime coatings are on rock fragments in places, but the loam-textured earth is noncalcareous. The A1 horizon is reddish brown and brown in hue of 7.5YR to 2.5YR.

Ringling soils in the Big Horn County Area are mapped only with Searing and Doney soils.

### Riverwash

Riverwash (RM) is along river channels. It includes gravel bars, low islands, and eroded flood plains that are nearly barren. Annual weeds and a few wildflowers grow in the stable areas. Frequent flooding produces yearly changes in size and shape of areas of this land type. The alluvial material of these areas is mainly sand, loamy sand, gravelly sand, and sandy gravel. A thin layer of loam covers small spots in slack water areas.

Riverwash is suitable for wildlife. Capability unit VIIIs-1 dryland; not placed in a range site or windbreak suitability group.

### Rock Outcrop

Rock outcrop is mapped only in complex with other mapping units. It consists of exposures of such bare, hard bedrock as limestone, sandstone, shale, and granite. It is on ledges and isolated pinnacles. Ledges that form canyon rims act as barriers to the movement of game animals and livestock.

Rock outcrop is used mainly for recreation, watershed, and wildlife. Capability unit VIIIs-1 dryland; not placed in a range site or windbreak suitability group.

**Rock outcrop-Duncom complex, very steep (RN).**—This complex is on the rims and sides and in the narrow bottoms of deep canyons and valleys in the sedimentary highlands. It is 50 to 70 percent Rock outcrop, 15 to 25 percent Duncom channery loam, and 5 to 15 percent Babb channery loam and Hanson channery loam. Slopes are 35 to 100 percent. Areas range from 100 to 800 acres in size. Relief is 200 to 900 feet. Rock outcrop occurs as ledges and pinnacles. The Duncom soil is along canyon rims and spur ridges that project from the canyon sides. It has slopes of 35 to 75 percent. The Babb and Hanson soils are on the coluvial slopes below Rock outcrop and in narrow valleys. They have a cover of juniper, Douglas-fir, ponderosa pine, limber pine, ninebark, and skunkbush sumac.

Runoff is rapid, and the hazard of erosion is moderate. These soils are used from range, wildlife, watershed, and recreation. The canyon rims act as barriers to game travel. Capability unit VIIe-1 dryland; Shallow range site, 20- to 24-inch precipitation zone; windbreak suitability group 4.

**Rock outcrop-Lap complex, very steep (RO).**—This complex is on the rims and sides and in the bottoms of deep canyons and valleys in the sedimentary highlands. It is 45 to 60 percent Rock outcrop and 40 to 55 percent Lap channery loam. Slopes are 15 to 75 percent. Rock outcrop occurs mainly as ledges on canyon rims and on the canyon sides. The Lap soil



is on narrow ridges, above the rock ledges, and on the lower sides of the canyons. It has slopes of 15 to 25 percent. Rock outcrop has slopes of 25 to 75 percent. Included in mapping are areas where the underlying material of the Lap soil is light reddish brown and red.

Runoff is rapid, and the hazard of erosion is moderate. These soils are suited to range, wildlife, watershed, and recreation. The canyon rims act as barriers to game travel. Capability unit VIIe-1 dryland; Shallow range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**Rock outcrop-Pultney complex, very steep (RP).**—This complex is on steep valley sides and escarpments along mountain fronts. It is 50 to 65 percent Rock outcrop and 35 to 50 percent Pultney channery loam. Limestone, shale, and sandstone outcrops of varying color are on the rims and upper sides of the valleys and on ledges on the mountain front. Slopes are 35 to 95 percent. The Pultney soil is above and between the rock ledges and has slopes of 35 to 50 percent. The Pultney soil in this complex has a profile similar to the one described as representative of the series, but 5 to 15 percent of the surface is covered with limestone, shale, chert, and sandstone fragments of channer and gravel size.

Runoff is rapid, and the hazard of erosion is severe. These soils are suited to range, watershed, wildlife, and recreation. Capability unit VIIe-1 dryland; Shallow range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

**Rock outcrop-Rentsac complex, rolling (RR).**—This complex is on sloping bedrock uplands and foothills. It is about 40 percent Rock outcrop, 40 percent Rentsac loam, and 20 percent Dast sandy loam and Absarokee clay loam. Outcrops of sandstone and conglomerate make a local relief of 1 foot to 5 feet. Slopes are 5 to 15 percent. Where drainageways have eroded through the bedrock, a rock ledge, 2 to 5 feet thick, forms the edge of the drainageways. The Rentsac soil is in 1/10- to 1/4-acre patches mixed with Rock outcrop. The Dast soil is along low sandstone ledges on higher knolls and ridges. The Absarokee soil is at the heads of drainageways. In some places fine pebble-sized fragments weathered from the conglomerate rocks are scattered through the soils. The soils in this complex have a reddish-brown and light reddish-brown subsoil and substratum.

Runoff is medium, and the hazard of erosion is moderate. These soils are suited to range, wildlife, watershed, and recreation. Capability unit VIe-1 dryland; Shallow range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**Rock outcrop-Windham complex, very steep (RS).**—This complex is on very steep canyons and along mountain fronts. It is 60 to 70 percent Rock outcrop and 30 to 40 percent Windham stony loam. Slopes are 50 to 100 percent. In the canyons Rock outcrop is on the rims and upper sides, and the Windham soil is in the colluvium below Rock outcrop. On the mountain fronts Rock outcrop occurs as low ledges in the Windham soils and as the upper part of the mountain. Included in mapping are areas of Lap channery loam on mountain fronts.

Runoff is rapid, and the hazard of erosion is slight. These soils are suited to game range, watershed, and recreation. The canyon rims act as barriers to game travel. Capability unit VIIe-1 dryland; Thin Breaks range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

### Rottulee Series

The Rottulee series consists of moderately deep, undulating to rolling, well-drained soils in the sedimentary uplands. Slopes range from 2 to 15 percent. These soils formed in place in material weathered from mixed shale and limestone. Elevation ranges from 4,500 to 5,500 feet.

The native vegetation is mainly green needlegrass, bluebunch wheatgrass, Hoods phlox, prairie junegrass, and gayfeather. Annual precipitation is 17 to 18 inches, the average annual soil temperature is 45° to 47° F, and the frost-free period is 90 to 105 days.

In a representative profile the surface layer is dark-brown silt loam about 2 inches thick. The subsoil is reddish-brown and light reddish-brown silt loam about 13 inches thick. The substratum is light reddish-brown gravelly light clay loam. Shattered limestone is at a depth of about 22 inches.

Permeability is moderate, and available water capacity is low. The effective rooting depth is about 24 inches. These soils are used for range, wildlife, recreation, and watershed.

Representative profile of Rottulee silt loam, undulating, in grassland, 660 feet north and 200 feet east of the SW. corner sec. 18, T. 8 S., R. 33 E.

- A1—0 to 2 inches, dark-brown (7.5YR 4/2) silt loam, dark brown (7.5YR 3/2) moist; weak, thin, platy structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; slightly effervescent; clear, smooth boundary.
- B1—2 to 6 inches, reddish-brown (5YR 5/3) silt loam, dark reddish brown (5YR 3/3) moist; weak, medium, prismatic structure; slightly hard, very friable, slightly sticky and plastic; common very fine roots; common very fine tubular pores; slightly effervescent; clear wavy boundary.
- B2—6 to 10 inches, light reddish-brown (5YR 6/3) heavy silt loam, reddish brown (5YR 4/4) moist; moderate, medium, prismatic structure; hard, friable, sticky and plastic; common very fine roots; common fine and very fine tubular pores; slightly effervescent; clear, wavy boundary.
- B3—10 to 15 inches, light reddish-brown (5YR 6/3) heavy silt loam, reddish brown (5YR 4/4) moist; moderate, medium and fine, blocky structure; hard, friable, sticky and plastic; common very fine roots; common very fine tubular pores; strongly effervescent; few threads of segregated lime; clear, wavy boundary.
- Cca—15 to 22 inches, light reddish-brown (5YR 6/4) gravelly light clay loam, yellowish red (5YR 5/6) moist; weak, fine, blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; 20 percent (volume) shale fragments; strongly effervescent; common fine, segregated lime threads; gradual boundary.
- R—22 inches, shattered limestone.

Depth to bedrock ranges from 20 to 30 inches. The soil between depth of 10 inches and the bedrock is silt loam, loam, or light clay loam. Shale and limestone fragments of gravel size increase with increasing depth to as much as



30 percent just above the bedrock. Hue ranges from 7.5YR to 10R throughout.

**Rottulee silt loam, gently undulating (Rt).**—This soil is on smooth parts of sloping bedrock uplands along mountain fronts. Slopes are 2 to 4 percent. The soil has a profile similar to the one described as representative of the series, but it is less sloping. Included in mapping are areas of Peritsa silt loam in broad swales and shallow troughs between ridges.

Runoff is slow, and the hazard of erosion is slight. This soil is used for range, hay, wildlife, recreation, watershed, and dryfarmed crops. Capability unit IIe-2 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 3L.

**Rottulee silt loam, undulating (Ru).**—This soil is on broad ridges between deep, narrow valleys. Slopes are 4 to 8 percent. The soil has the profile described as representative of the series.

Included with this soil in mapping are areas where platy red shale is at a depth of 20 to 40 inches and spots of soils that have a surface layer of channery and cobbly loam.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for wildlife, range, hay, and dryfarmed crops. Capability unit IIIe-2 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 3L.

**Rottulee silt loam, rolling (Rv).**—This soil is on tilted bedrock uplands along mountain fronts and in drainageways that cut through limestone and red shale hills. Slopes are 8 to 15 percent. The soil has a profile similar to the one described as representative of the series, but it is steeper. Included in mapping are areas of Abac channery loam and Peritsa silt loam.

Runoff is rapid, and the hazard of erosion is severe. This soil is used for wildlife, recreation, watershed, range, hay and pasture. Capability unit IVe-2 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 3L.

**Rottulee-Abac complex, rolling (RW).**—This complex is made up of rolling soils on wide ridges between deep, narrow drainageways in limestone and red shale highlands. It is about 65 percent Rottulee silt loam, 25 percent Abac cobbly loam, and 10 percent Rock outcrop. Slopes are 8 to 15 percent. The soils are intermixed, but surface fragments of cobble size and Rock outcrop mark the areas of Abac soils. The Rottulee and Abac soils in this complex have profiles similar to the ones described as representative of their respective series, but they are steeper, and the Abac soil has limestone fragments of cobble size on the surface.

Runoff is rapid, and the hazard of erosion is severe. These soils are used for range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 3L.

## Ryorp Series

The Ryorp series consists of moderately deep, undulating and rolling, well-drained soils on ridges and valley sides in the mountainous uplands. Slopes are mostly 4 to 8 percent, but they range to 15 percent. These soils formed in place in material weathered

from noncalcareous sandstone. Elevation ranges from 6,000 to 7,500 feet.

The native vegetation is mainly lodgepole pine and an understory of huckleberry, oregongrape, and bedstraw. Annual precipitation is 18 to 20 inches, the average annual soil temperature is 40° to 42° F, and the frost-free period is 60 to 75 days.

In a representative profile a thin mat of pine needles overlies the surface layer of light brownish-gray fine sandy loam about 2 inches thick. The subsoil is pale-brown fine sandy loam about 19 inches thick. The substratum is pale-brown sandy loam. Sandstone is at a depth of about 34 inches.

Permeability is rapid, and available water capacity is low. The effective rooting depth is about 30 inches. These soils are used for woodland, watershed, recreation, and game range.

Representative profile of Ryorp sandy loam, undulating, in woodland, 1,320 feet south and 300 feet east of the NW. corner of sec. 29, T. 6 S., R. 26 E.

O—2 inches to 0, loose mat of partly decomposed pine needles and twigs.

A2—0 to 2 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak, thin, platy structure; soft very friable, nonsticky and nonplastic; many coarse and medium and common fine and very fine roots; clear, smooth boundary.

B2—2 to 21 inches, pale-brown (10YR 6/3) fine sandy loam, dark brown (10YR 4/3) moist; few coarse, brown (10YR 5/4) iron mottles that have a diffuse boundary; moderate, coarse, prismatic structure; slightly hard, very friable, nonsticky and nonplastic; common coarse, medium, fine, and very fine pores; gradual wavy boundary.

C—21 to 34 inches, pale-brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; massive; hard, very friable, nonsticky and nonplastic; few fine roots; few fine tubular pores; abrupt boundary.

R—34 inches, noncalcareous sandstone.

Depth to bedrock ranges from 20 to 40 inches. Hue ranges from 2.5Y to 7.5YR throughout. Sandstone fragments range from 0 to 30 percent above the bedrock. The B2 horizon ranges from brown to light yellowish brown. The B2 horizon and the upper part of the C horizon are 12 to 18 percent clay.

**Ryorp sandy loam, undulating (Ry).**—This soil is on broad ridges and the upper sides of mountain valleys. Areas are as much as 800 acres in size. Slopes are mostly 4 to 8 percent, but they range to 15 percent. Slopes range from 300 to 600 feet long. Included in mapping are areas of soils that have a surface layer of loam and loamy fine sand.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for woodland, recreation, watershed, and game range. The principal tree species are lodgepole pine and limber pine. The average site index for the lodgepole pine is 65.

Timber harvest on this soil is not limited by terrain or soil characteristics. Access is along the broad ridges and hilltops. Areas in the Pryor Mountains are logged. Area burning of slash helps to assure regrowth. Capability unit IVe-2; not placed in a range site or windbreak suitability group.

## Saline Land

Saline land (SA) is in river and perennial stream val-



leys on seeped and saline-affected areas on flood plains, terraces, and fans. Most areas have a water table at a depth of 3 to 6 feet. Some areas below irrigation canals have a water table at the surface during part of the growing season. The soil material ranges from loam to clay and from 3 feet to more than 6 feet in thickness. Slopes range from 0 to 35 percent, but they are mostly 0 to 4 percent. The salinity effect is estimated to range from moderate to severe. Salt crusts, common early in spring, give the areas a light-gray color. Most areas cannot be reclaimed because they lack drainage outlets.

Runoff is slow, and the hazard of erosion is slight. In the perennial stream valleys, channel erosion is active during spring runoff.

Saline land is suited to range and wildlife. Capability unit VIw-1 dryland; Saline Lowland range site, 10- to 14-inch precipitation zone; windbreak suitability group 3S.

### Savage Series

The Savage series consists of deep, nearly level to strongly sloping and rolling, well-drained soils on fans, terraces, and foot slopes. Slopes are mostly 0 to 15 percent, but they range to 20 percent. These soils formed in calcareous alluvium or loess derived from mixed sources that have a low proportion of sand. Elevation ranges from 3,600 to 4,200 feet.

The native vegetation is mainly western wheatgrass, green needlegrass, prairie junegrass, and woolly indian-wheat. Annual precipitation is 15 to 16 inches, the average annual soil temperature is 45° to 47° F, and the frost-free period is 95 to 115 days.

In a representative profile the surface layer is dark grayish-brown silt loam about 2 inches thick. The subsoil is grayish-brown and dark grayish brown silty clay loam and silty clay about 21 inches thick. The substratum is olive silty clay and pale-olive silty clay loam that extends to a depth of 61 inches or more.

Permeability is moderately slow, and available water capacity is moderate or high. The effective rooting depth is 60 inches or more. These soils are used for dryfarmed and irrigated crops, wildlife, recreation, watershed, and range.

Representative profile of Savage silty clay loam, 2 to 4 percent slopes, in grassland, 1,320 feet north and 50 feet east of the SW. corner sec. 8, T. 9 S., R. 35 E.

A1—0 to 2 inches, dark grayish-brown (2.5Y 4/2) heavy silt loam, very dark brown (2.5Y 2/2) moist; weak, thick, platy structure; hard, friable, slightly sticky and plastic; many fine and few medium roots; clear, smooth boundary.

B21t—2 to 6 inches, grayish-brown (2.5Y 5/2) heavy silty clay loam, very dark grayish brown (2.5Y 3/2) moist; moderate, medium and coarse, prismatic structure parting to moderate, medium, blocky; very hard, firm, very sticky and very plastic; thin, patchy clay films on peds; common very fine roots; common fine pores, clear, wavy boundary.

B22t—6 to 16 inches, dark grayish-brown (2.5Y 4/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; moderate, medium and coarse, prismatic structure parting to strong, medium, blocky; very hard, firm, very sticky and very plastic; continuous clay films on peds; common very fine roots; common fine tubular pores; clear, wavy boundary.

B3ca—16 to 23 inches, grayish-brown (2.5Y 5/2) silty clay,

dark grayish brown (2.5Y 4/2) moist; strong, coarse, prismatic structure parting to moderate, medium and coarse, blocky; very hard, very firm, very sticky and very plastic; few very fine and fine roots; few fine pores; strongly effervescent; common fine lime threads and soft, medium lime masses; gradual, wavy boundary.

C1ca—23 to 29 inches, olive (5Y 5/3) silty clay, olive (5Y 4/3) moist; weak, coarse, prismatic structure parting to moderate, medium, blocky; very hard, very firm, very sticky and very plastic; few fine roots; common very fine and fine pores; strongly effervescent; common fine lime threads and medium, soft lime masses; gradual, wavy boundary.

C2—29 to 39 inches, olive (5Y 5/3) light silty clay, olive (5Y 4/3) moist; weak, medium, blocky structure; very hard, very firm, very sticky and very plastic; few fine roots; common fine pores; strongly effervescent; common fine lime threads and medium, soft lime masses; diffuse, irregular boundary.

C3—39 to 61 inches, pale-olive (5Y 6/3) silty clay loam, olive (5Y 4/3) moist; massive; hard, firm, sticky and plastic; few fine roots; few fine pores; strongly effervescent; few fine, soft lime masses.

Hue ranges from 2.5Y to 7.5YR throughout. The A1 horizon is dark grayish-brown and grayish-brown silt loam or silty clay loam. The B2t horizon ranges from 35 to 45 percent clay and is grayish brown, dark grayish brown, and light yellowish brown.

**Savage silty clay loam, 0 to 2 percent slopes (Sd).—**This nearly level soil is on narrow terraces along stream channels. In places the surface is broken by channel scars that are 1 foot to 2 feet deep. The soil has a profile similar to the one described as representative of the series, but it is less sloping.

Runoff is slow, and the hazard of erosion is slight. This soil is used for irrigated and dryfarmed crops, hay, wildlife, and range. Capability unit IIs-2 dryland, IIC-2 irrigated; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Savage silty clay loam, 2 to 4 percent slopes (Sea).—**This gently sloping soil is on terraces and fans. It has the profile described as representative of the series.

Runoff is slow, and the hazard of erosion is slight. This soil is used for irrigated and dryfarmed crops, hay, wildlife, and range. Capability unit IIC-2 dryland, IIE-1 irrigated; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Savage silty clay loam, 4 to 8 percent slopes (Seb).—**This sloping soil is on fans and foot slopes. Areas are less than 30 acres in size and are generally crossed by drainage channels that are 5 to 10 feet deep. Most areas receive runoff from soils above them. Slopes range from 200 to 350 feet long. The soil has a profile similar to the one described as representative of the series, but it is steeper.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for dryfarmed crops, hay, wildlife, and range. Capability unit IIIE-2 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Savage silty clay loam, undulating (Sec).—**This undulating soil is on loess-mantled hills and dissected terraces. Slopes are 4 to 8 percent. Most areas are crossed by roughly parallel drainageways that are 5 to 25 feet deep. Slopes are 6 to 8 percent on the sides of drainageways and 4 to 5 percent in other areas. The soil has a profile similar to the one described as representative of the series, but it is steeper.



Runoff is medium, and the hazard of erosion is moderate. This soil is used for dryfarmed crops, hay, wildlife, and range. Capability unit IIIe-2 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Savage silty clay loam, rolling (Sed).**—This rolling soil is on eroded parts of gravel terraces and loess-mantled hills. Slopes are 8 to 15 percent. Areas range from 20 to 100 acres in size. Local relief is 20 to 50 feet. The soil has a profile similar to the one described as representative of the series, but it is steeper.

Included with this soil in mapping are areas of Judith loam, which has surface fragments of gravel size, and areas of Wayden silty clay loam.

Runoff is rapid, and the hazard of erosion is severe. This soil is used for wildlife, range, hay, pasture, and dryfarmed crops. Capability unit IVe-2 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Savage-Wayden silty clay loams, 4 to 15 percent slopes (Sef).**—This complex is made up of gently sloping and strongly sloping soils. It is 40 to 55 percent Savage silty clay loam, 20 to 35 percent Wayden silty clay loam, and 5 to 20 percent Doney, Regent, Farnuf, and Frazer soils. The Savage soil is on foot slopes, terraces, and fans between the shale knolls and ridges that are occupied by the Wayden soil. The Doney and Regent soils are near the Wayden soil. Slopes are 4 to 8 percent on the valley bottoms and the lower parts of fans and foot slopes. The Wayden soils and nearby soils have slopes of 12 to 15 percent. The Savage soil in this complex has a profile similar to the one described as representative of the Savage series, but it is steeper.

Runoff is medium, and the hazard of erosion is moderate. Most areas receive runoff from the hills that border the valleys. Channel erosion is active in spring and early in summer. These soils are used for wildlife, range, hay, and pasture. Capability unit IVe-2 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Savage and Frazer soils, 0 to 4 percent slopes (SF).**—This undifferentiated soil group is made up of nearly level and gently sloping Savage silty clay loam and Frazer silty clay. Mapped areas may include only one of these soils, or both may be present. They occur in no predictable pattern. The Savage and Frazer soils in this mapping unit have profiles similar to the ones described as representative of their respective series, but the surface layer is silt loam and silty clay loam and in places the water table is below a depth of 3 feet.

Runoff is slow, and the hazard of erosion is severe. Areas at the mouths of tributary drainageways are overflowed early in spring. These soils are used for range, wildlife, recreation, and watershed. Capability unit VIw-1 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

## Sawcreek Series

The Sawcreek series consists of moderately deep, rolling and hilly, well-drained soils on valley sides, hills, and ridges in the mountainous uplands. Slopes range from 8 to 35 percent. These soils formed in place

in material weathered from noncalcareous sandstone. Elevation ranges from 5,500 to 6,500 feet.

The native vegetation is mainly limber pine, Douglas-fir, Idaho fescue, lupine, needleandthread, and big sagebrush. Annual precipitation is 18 to 20 inches, the average annual soil temperature is 43° to 45° F, and the frost-free period is 70 to 85 days.

In a representative profile the surface layer is dark-brown sandy loam about 6 inches thick. The subsoil is dark-brown and yellowish-brown sandy loam about 9 inches thick. The substratum is yellowish-brown and brown sandy loam. Sandstone is at a depth of about 36 inches.

Permeability is rapid, and available water capacity is low. The effective rooting depth is about 3 feet. These soils are used for range, recreation, watershed, and game range.

Representative profile of Sawcreek sandy loam, in an area of Splitro-Sawcreek sandy loams, rolling, in grassland, 660 feet south and 1,320 feet west of the NE. corner sec. 17, T. 7 S., R. 26 E.

- A11—0 to 2 inches, dark-brown (10YR 4/3) light sandy loam, very dark grayish brown (10YR 3/2) moist; weak, fine, granular structure; soft, friable, non-sticky and nonplastic; many very fine and micro roots; clear, smooth boundary.
- A12—2 to 6 inches, dark-brown (10YR 4/3) sandy loam, very dark grayish brown (10YR 3/2) moist; weak, coarse, prismatic structure; slightly hard, friable, nonsticky and slightly plastic; many fine, very fine, and micro roots; gradual, wavy boundary.
- B21—6 to 11 inches, dark-brown (10YR 4/3) sandy loam, dark brown (10YR 3/3) moist; moderate, coarse, prismatic structure; hard, friable, slightly sticky and slightly plastic; few micro roots; few micro pores; gradual, wavy boundary.
- B22—11 to 15 inches, yellowish-brown (10YR 4/3) sandy loam, dark brown (10YR 4/3) moist; moderate, coarse, prismatic structure parting to moderate, coarse, blocky; hard, friable, slightly sticky and slightly plastic; few very fine roots; few very fine pores; gradual, wavy boundary.
- C1—15 to 23 inches, yellowish-brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; weak, coarse, blocky structure; hard, friable, slightly sticky and slightly plastic; few micro roots; common micro pores; gradual, wavy boundary.
- C2—23 to 36 inches, brown (10YR 5/3) light sandy loam, dark yellowish brown (10YR 4/4) moist; weak, coarse, blocky structure; hard, friable, nonsticky and slightly plastic; abrupt, wavy boundary.
- R—36 inches, hard, noncalcareous sandstone.

Depth to bedrock ranges from 20 to 40 inches. The soil below a depth of 10 inches and above bedrock is sandy loam. The soil ranges from 0 to 15 percent coarse fragments. Hue is 10YR or 7.5YR throughout, and chroma is 2 or 3. The dark-colored surface layer ranges from 8 to 13 inches in thickness. The A1 horizon is dark brown and brown. The C horizon is brown, yellowish brown, and light yellowish brown.

Sawcreek soils in the Big Horn County Area are mapped only with Splitro soils.

## Searing Series

The Searing series consists of moderately deep, undulating to hilly, well-drained soils in the sedimentary uplands. Slopes range from 4 to 35 percent. These soils formed in place in material weathered from burned shale and porcelanite rock. Elevation ranges from 3,500, to 5,000 feet.



The native vegetation is mainly dryland sedges, Idaho fescue, fringed sagewort, green sagewort, and cudweed sagewort. Annual precipitation is 15 to 17 inches, the average annual soil temperature is 45° to 47° F, and the frost-free period is 95 to 115 days.

In a representative profile the surface layer is dark reddish-gray loam about 6 inches thick. The subsoil is reddish-brown loam and clay loam about 18 inches thick. The substratum is red channery loam. Shale and sandstone are at a depth of about 30 inches.

Permeability is moderate, and available water capacity is low or moderate. The effective rooting depth is about 30 inches. These soils are used for range, wildlife, recreation, watershed, and dryfarmed crops.

Representative profile of Searing loam, undulating, in grassland, 300 feet west and 200 feet north of the SE corner sec. 9, T. 5 S., R. 38 E.

A11—0 to 2 inches, dark reddish-gray (5YR 4/2) loam, dark reddish brown (5YR 2/2) moist; weak, thin, platy structure parting to weak, coarse, granular; soft, very friable, nonsticky and slightly plastic; clear boundary.

A12—2 to 6 inches, dark reddish-gray (5YR 4/2) loam, dark reddish brown (5YR 2/2) moist; moderate, thick, platy structure; slightly hard, friable, non-sticky and slightly plastic; clear, smooth boundary.

B1—6 to 11 inches, reddish-brown (5YR 4/4) loam, dark reddish brown (5YR 3/3) moist; moderate, weak, prismatic structure parting to weak, medium, blocky; hard, friable, slightly sticky and plastic; clear, wavy boundary.

B2—11 to 17 inches, reddish-brown (2.5YR 5/4) clay loam, dark reddish brown (2.5YR 3/4) moist; moderate, medium, prismatic structure parting to moderate, medium, blocky; hard, friable, sticky and plastic; gradual, wavy boundary.

B3—17 to 24 inches, reddish-brown (2.5Y 5/4) loam, dark red (2.5Y 3/6) moist; moderate, fine and medium, blocky structure; hard, friable, sticky and plastic; gradual, wavy boundary.

C—24 to 30 inches, red (2.5Y 5/5) channery loam, dark red (2.5Y 4/6) moist; weak, medium, blocky structure; slightly hard, friable, slightly sticky and slightly plastic; 25 percent (volume) weathered shale and sandstone fragments; slightly effervescent; gradual, wavy boundary.

R—30 to 40 inches, interbedded red shale and sandstone; strongly effervescent.

Depth to shale and porcelanite ranges from 20 to 40 inches. Hue ranges from 5YR to 10R throughout. The soil between a depth of 10 inches and the bedrock is loam or light clay loam. The A and B horizons range from 10 to 24 inches in combined thickness. The A horizon is dark reddish gray, reddish gray, and weak red. The C horizon is red, reddish brown, and light red. The lower part of the C horizon ranges from 5 to 30 percent coarse fragments.

**Searing loam, undulating (Sg).**—This undulating soil is on wide ridges in dissected shale highlands. Slopes are 4 to 8 percent, and they range from 50 to 250 feet long. The soil has the profile described as representative of the series. Included in mapping are spots of Ringling channery loam.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for wildlife, recreation, watershed, range, hay, and limited dryfarmed crops. Irregularly shaped areas and the spots of Ringling soils are limitations to use of this soil. Capability unit IIIe-2 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 2M.

**Searing loam, hilly (SH).**—This hilly and steep soil is

on hills in dissected shale highlands. Slopes are mostly 15 to 25 percent, but they range to 35 percent. Areas range from 100 to 300 acres in size. Slopes range from 300 to 800 feet long. The native vegetation consists of thick stands of sawlog and pole-size ponderosa pine and an understory of ninebark, oregongrape, and horsemint. The soil has a profile similar to the one described as representative of the series, but the surface layer and subsoil are 15 to 24 inches in combined thickness, and the material below a depth of 15 inches is 15 to 30 percent shale and sandstone fragments. Included in mapping are areas of Doney loam and Ringling channery loam along ridgetops.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for woodland, watershed, recreation, and game range. The principal tree species is ponderosa pine. Western hawthorn and ash are scattered along streams and valley bottoms. The average site index for ponderosa pine is 70.

Timber harvest on this soil is not limited by terrain or soil characteristics. Access is along broad ridges and through wide valleys. Trees 12 inches or more in diameter are harvested. Release cutting is needed on the north faces of many valleys. Western hawthorn increases in many heavily logged areas. The hazard of wind breakage is moderate after heavy wet snow in spring. Piling and burning of slash helps to increase the cover of grass and reduce infestation of bark and pine beetles. Capability unit VIe-1 dryland; not placed in a range site or windbreak suitability group.

**Searing-Ringling complex, rolling (SI).**—This complex is made up of rolling soils in the sedimentary uplands. It is 45 to 60 percent Searing loam, 30 to 45 percent Ringling stony loam, and 5 to 10 percent Reeder and Farnuf loam. Slopes are 8 to 15 percent. The Searing soil is on ridges and hillsides, in saddles between hills, and at the heads of drainageways. The Ringling soil is on hilltops, narrow ridges, and steep side slopes from which rock crops out.

Runoff is medium, and the hazard of erosion is moderate. These soils are used for wildlife, recreation, watershed, range, and pasture. Capability unit IVe-2 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 3M.

## Shaak Series

The Shaak series consists of deep, nearly level to strongly sloping and undulating to rolling, well-drained soils on hills and benches. Slopes range from 2 to 15 percent. These soils formed in clay loam and silty clay loam alluvium. Elevation ranges from 3,500 to 5,000 feet.

The native vegetation is mainly western wheatgrass, Sandberg bluegrass, fringed sagewort, blue grama, Idaho fescue, and prairie junegrass. Annual precipitation is 14 to 17 inches, the average annual soil temperature is 44° to 47° F, and the frost-free period is 90 to 105 days.

In a representative profile the surface layer is grayish-brown light clay loam about 3 inches thick. The subsoil is grayish-brown, brown, light olive-brown, and pale-olive silty clay loam, clay, and clay loam about 22 inches thick. The substratum is pale-olive and light



olive-gray clay loam that extends to a depth of 63 inches or more.

Permeability is slow, and available water capacity is high. The effective rooting depth is 60 inches or more. These soils are used for dryfarmed crops, wildlife, recreation, watershed, and range. They are suitable for irrigation.

Representative profile of Shaak clay loam, 4 to 8 percent slopes, in grassland, 1,000 feet north and 1,200 feet east of the SW. corner sec. 15, T. 5 S., R. 25 E.

A1—0 to 3 inches, grayish-brown (10YR 5/2) light clay loam, very dark grayish brown (10YR 3/2) moist; weak, very thin, platy structure; slightly hard, friable, slightly sticky and plastic; common very fine roots; many clean sand and silt grains; clear, smooth boundary.

B1—3 to 6 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, blocky structure; hard, friable, very sticky and very plastic; common very fine roots; common very fine pores; few clean sand grains; clear, smooth boundary.

B21t—6 to 13 inches, brown (10YR 5/3) clay, dark yellowish brown (10YR 4/4) moist; moderate, medium, prismatic structure parting to strong, fine and very fine, blocky; very hard, very firm, very sticky and very plastic; common very fine roots; many very fine pores; moderately thick, patchy clay films on peds; gradual, wavy boundary.

B22t—13 to 18 inches, light olive-brown (2.5Y 5/4) heavy clay loam, olive brown (2.5Y 4/4) moist; strong, medium, prismatic structure parting to strong, medium and fine, blocky; very hard, firm, very sticky and very plastic; common very fine roots; many very fine pores; moderately thick, patchy clay films on peds; clear, wavy boundary.

B3—18 to 25 inches, pale-olive (5Y 6/3) heavy clay loam, olive (5Y 4/3) moist; weak, medium, prismatic structure parting to moderate, medium, blocky; few very fine roots; common very fine pores; slightly effervescent; few indistinct, very fine lime threads; gradual, wavy boundary.

C1ca—25 to 31 inches, pale-olive (5Y 6/3) clay loam, olive (5Y 4/3) moist; moderate, coarse, blocky structure; very hard, firm, sticky and plastic; few very fine roots; common very fine pores; strongly effervescent; few indistinct, very fine lime threads; gradual, wavy boundary.

C2ca—31 to 41 inches, light olive-gray (5Y 6/2) light clay loam, olive (5Y 4/3) moist; weak, coarse, blocky structure; hard, friable, sticky and plastic; few very fine roots; common very fine pores; strongly effervescent; common fine lime threads and soft lime masses; diffuse, wavy boundary.

C3—41 to 63 inches, pale-olive (5Y 6/3) clay loam, olive (5Y 4/3) moist; massive; hard, friable, sticky and plastic; few very fine pores; strongly effervescent.

Depth to calcareous material ranges from 10 to 19 inches. The A1 horizon is light brownish-gray, grayish-brown, and dark grayish-brown clay loam, loam, or silty clay loam that contains many clear sand grains. In places there is a light brownish-gray A2 horizon that has an abrupt lower boundary. The B2t horizon is brown, dark grayish-brown, and yellowish-brown heavy clay loam, silty clay, or clay that is 35 to 55 percent clay. The Bca and Cca horizons are light brownish-gray, pale-yellow, pale-olive, and light olive-gray clay loam, silty clay loam, or light clay. The lower part of the C horizon ranges from 0 to 20 percent coarse fragments.

**Shaak clay loam, 4 to 8 percent slopes (Ska).**—This soil is on narrow foot slopes, fans, and terraces. Slopes range from 150 to 300 feet long. The soil has the profile described as representative of the series.

Runoff is medium, and the hazard of erosion is moderate. Areas on foot slopes receive runoff from

soils above them. This soil is used for irrigated and dryfarmed crops, hay, watershed, wildlife, recreation, and range. Capability unit IIIe-2 dryland, IVe-1 irrigated; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Shaak silty clay loam, 0 to 2 percent slopes (Skb).**—This nearly level soil is on high terraces and benches. Drainageways are not distinct, and runoff collects on flat slopes and in shallow depressions. The soil has a profile similar to the one described as representative of the series, but it is less sloping and has a surface layer of silty clay loam.

Included with this soil in mapping are areas of Lennep loam, Xavier silty clay loam, and Shonkin loam. The Lennep and Shonkin soils are on the level areas and in slight depressions.

Runoff is slow, and the hazard of erosion is slight. This soil is used for irrigated and dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIe-2 dryland, IIIe-1 irrigated; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Shaak silty clay loam, gently undulating (Skc).**—This gently undulating soil is on high terraces. Slopes are 2 to 4 percent. This soil has a profile similar to the one described as representative of the series, but it is less sloping and has a surface layer of silty clay loam. Included in mapping are areas of soils that have a surface layer of silty clay and areas of Xavier silty clay loam and Lennep loam.

Runoff is slow, and the hazard of erosion is slight. This soil is used for irrigated and dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIe-2 dryland, IIIe-3 irrigated; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Shaak silty clay loam, undulating (Skd).**—This soil is on narrow ridges and in drainageways in dissected loess-mantled and gravelly benches. Slopes are 4 to 8 percent. Local relief ranges from 25 to 75 feet. The soil has a profile similar to the one described as representative of the series, but the surface layer is silty clay loam. Included in mapping are areas of soils that have a surface layer of silty clay and areas of Lennep loam.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for dryfarmed crops, hay, wildlife, recreation, watershed, and range. It is also suited to limited irrigated crops. Capability unit IIIe-2 dryland, IVe-1 irrigated; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Shaak silty clay loam, rolling (Ske).**—This soil is on smooth valley sides, hills, fans, and terraces on dissected shale highlands that are covered with a mantle of loess and gravelly material. Slopes are 8 to 15 percent and 50 to 300 feet long. Local relief ranges from 15 to 125 feet. The soil has a profile similar to the one described as representative of the series, but it is steeper, the surface layer is silty clay loam, and as much as 10 percent of the surface is covered by fragments of gravel and cobble size.

Included with this soil in mapping are areas of soils that have a surface layer of silty clay and areas of Judith gravelly loam, Wayden silty clay loam, and



Grail silty clay. These included soils make up 10 to 35 percent of the total area of this mapping unit.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for wildlife, recreation, watershed, range, hay, pasture, and dryfarmed crops. Capability unit IVE-2 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Shaak complex, 4 to 15 percent slopes (SM).**—This complex is made up of gently sloping and strongly sloping soils in the dissected shale highlands. It is 45 to 60 percent Shaak clay loam and 40 to 55 percent Doney loam, Dast sandy loam, and Absher clay. Typically, it is below a sandstone and shale headwall that rims major valleys. Areas extend from the headwall to the valley bottom. Where several valleys are separated by low broad ridges that have slopes of less than 20 percent, the headwall is absent. Drainageways between the ridges make local relief of 35 to 65 feet. The Shaak soil is on broad ridges and knolls, on side slopes to drainageways and at the heads of drainageways. The Doney and Dast soils are on narrow ridges and at points where tributary drainageways enter the main valley. The Absher soil is at the heads of drainageways and on wide ridges where slopes are 4 percent. The Shaak soil on ridges is underlain by shale at a depth of 30 to 40 inches.

Runoff is medium, and the hazard of erosion is moderate. These soils are used for wildlife, recreation, watershed, range, hay, and pasture. Capability unit IVE-2 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 2M.

## Shale Outcrop

Shale outcrop (SOa) is on deeply dissected parts of shale uplands. The areas consist of a single shale escarpment or headwall or a combination of buttes, hills, and ridges that are 80 percent or more outcrops of soft shale. Along river valleys Shale outcrop in places is capped by terrace gravel 10 to 40 feet thick. In places the hilltops and ridgetops include patches of Norbert and Eltsac clays. Slopes range from 15 to 100 percent.

Runoff is very rapid, and the hazard of erosion is severe. The runoff water carries large amounts of sediment. The vegetation is mono lepis, white locoweed, and greasewood. Capability unit VIIIs-1 dryland; not placed in a range site or windbreak suitability group.

**Shale outcrop-Midway complex, steep (SOC).**—This complex is on deeply dissected clay shale highlands that have local relief of 50 to 200 feet. It is 35 to 70 percent shale outcrop and 25 to 65 percent Midway silty clay loam. Slopes are 25 to 90 percent. Areas occur as a single, nearly perpendicular escarpment along a valley or as a number of closely spaced narrow ridges and drainageways at the head of a valley. Single escarpment areas have one or two sandstone ledges that are 5 to 7 feet thick mixed with the shale. The Midway soil is on ridgetops, at the heads of drainageways, and on the lower third of escarpments. It has a profile similar to the one described as representative of the series, but it is steeper.

Runoff is rapid, and the hazard of erosion is severe. Erosion is active. Runoff waters carry large amounts

of sediment. These soils are used for range, wildlife, recreation, and watershed. Capability unit VIIe-1 dryland; Shale range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

**Shale outcrop-Norbert complex, hilly (SOd).**—This complex is on dissected shale uplands in mountain foothills. It is about 60 percent Shale outcrop and 40 percent Norbert, Absher, Nobe, and Eltsac clays. Slopes are 15 to 75 percent. Areas range from 100 to 300 acres in size. The land surface is broken by many narrow, actively eroding drainageways. Between the drainageways are 1- to 15-acre, flat or gently rounded buttes, hills, and ridges. Local relief is 50 to 125 feet. Shale outcrop is on the steep sides of hills, ridges, and buttes and in drainageways. The Norbert and Eltsac soils are on ridgetops and hilltops. The Absher soil is on flat hills and buttes. The Nobe soil is along drainageways.

Runoff is rapid, and the hazard of erosion is severe. Runoff waters carry large amounts of sediment. These soils are used for range, recreation, watershed, and wildlife. Capability unit VIIe-1 dryland; Shale range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

## Shonkin Series

The Shonkin series consists of deep, nearly level, somewhat poorly drained soils in shallow basins on high terraces. Slopes range from 0 to 1 percent. These soils formed in clay loam, silty clay loam, and clay alluvium. Elevation ranges from 3,400 to 4,000 feet.

The native vegetation is mainly sedges, western wheatgrass, barnyardgrass, and sour clover. Annual precipitation is 14 to 17 inches, the average annual soil temperature is 47° to 49° F, and the frost-free period is 105 to 115 days. Water ponds for a few days to a few weeks after the snow melts and after heavy rain.

In a representative profile the surface layer is light-gray clay loam about 7 inches thick. The subsoil is light olive-gray clay about 19 inches thick. The substratum is pale-olive silty clay that extends to a depth of 60 inches or more.

Permeability is slow, and available water capacity is high. The effective rooting depth is 60 inches or more. These soils are used for dryfarmed crops, wildlife, recreation, watershed, and range.

Representative profile of Shonkin clay loam, in a cultivated area, 990 feet north and 1,100 feet west of the SE. corner sec. 1, T. 3 S., R. 32 E.

- Ap1—0 to 3 inches, light-gray (5Y 7/1) clay loam, olive gray (5Y 5/2) moist; moderate, thin, platy structure; slightly hard, friable, nonsticky and slightly plastic; abrupt, smooth boundary.
- Ap2—3 to 7 inches, light-gray (5Y 7/1) clay loam, olive gray (5Y 5/2) moist; few fine (5Y 5/4 dry) mottles; moderate, thin, platy structure; slightly hard, friable, nonsticky and slightly plastic; abrupt, smooth boundary.
- B21t—7 to 12 inches, light olive-gray (5Y 6/2) clay, olive gray (5Y 5/2) moist; moderate, coarse, prismatic structure parting to strong, fine and medium, blocky; very hard, very firm, very sticky and very plastic; moderately thick, patchy clay films on peds and partly filling fine pores; clear boundary.



B2t—12 to 19 inches, light olive-gray (5Y 6/2) clay, olive gray (5Y 5/2) moist; weak, medium, prismatic structure parting to strong, fine and medium, blocky; very hard, very firm, very sticky and very plastic; thin, patchy clay films on peds; clear boundary.

B3ca—19 to 26 inches, light olive-gray (5Y 6/2) clay, olive gray (5Y 5/2) moist; moderate, fine, blocky structure; very hard, very firm, very sticky and very plastic; slightly effervescent; clear boundary.

C1—26 to 36 inches, pale-olive (5Y 6/3) silty clay, olive (5Y 5/3) moist; weak, medium, subangular blocky structure; very hard, firm, sticky and very plastic; strongly effervescent; common coarse lime masses; clear boundary.

C2—36 to 60 inches, pale-olive (5Y 6/3) silty clay, olive (5Y 5/3) moist; massive; hard, firm, sticky and very plastic; strongly effervescent; common coarse lime masses; few rounded pebbles in lower part.

The A and B horizons range from 16 to 28 inches in combined thickness. The A horizon is light brownish gray and light gray in chroma of 1 or 2. The B2t horizon is light olive-gray, grayish-brown, and light olive-brown silty clay or clay. Sodium saturation ranges from 5 to 10 percent in the lower part of the B horizon and increases with increasing depth in the C horizon. The lower part of the C horizon in places contains gypsum crystals.

**Shonkin clay loam (Sp).**—This soil is in closed depressions and swales in high terraces and benches. Slopes are 0 to 1 percent. Areas range from 2 to 15 acres in size.

Runoff is none to slow, and the hazard of erosion is slight. Flooding in spring and early in summer occurs about 1 year out of 3. The depth of the water ranges from 1½ to 3 feet. Crop damage varies with the water depth and time of flooding. This soil is used for dry-farmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIIw-2 dryland; Overflow range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

## Sofia Series

The Sofia series consists of deep, nearly level and gently undulating, well-drained soils on terraces and fans. Slopes range from 0 to 4 percent. These soils formed in calcareous silty clay loam or silty clay alluvium. Elevation ranges from 3,500 to 4,000 feet.

The native vegetation is mainly green needlegrass, prairie junegrass, and western wheatgrass. Annual precipitation is 15 to 16 inches, the average annual soil temperature is 47° to 49° F, and the frost-free period is 100 to 115 days.

In a representative profile the surface layer is brown silty clay about 7 inches thick. The subsoil is dark-brown and brown silty clay about 9 inches thick. The substratum is pale-brown silty clay. Unconformable very gravelly sand is at a depth of 40 inches.

Permeability is slow, and available water capacity is high. The effective rooting depth is 40 inches or more. These soils are used for dryfarmed crops, wildlife, recreation, watershed, and range. They are suitable for irrigation.

Representative profile of Sofia silty clay, 0 to 2 percent slopes, in a cultivated area, 2,500 feet north and 200 feet east of the SW. corner sec. 32, T. 4 S., R. 32 E.

Ap—0 to 7 inches, brown (10YR 5/3) silty clay, dark brown (10YR 3/3) moist; weak, blocky structure parting to moderate, fine, granular; very hard,

firm, very sticky and very plastic; abrupt, smooth boundary.

B2t—7 to 12 inches, dark-brown (10YR 4/3) heavy silty clay, dark brown (10YR 3/4) moist; weak, medium, prismatic structure parting to strong, medium and fine, blocky; very hard, very firm, very sticky and very plastic; few very fine and fine roots; common very fine and fine and few medium tubular pores; continuous, organically stained films on faces of peds; clear boundary.

B3—12 to 16 inches, brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; weak, medium, prismatic structure parting to moderate, medium and fine, blocky; very hard, firm, very sticky and plastic; few very fine roots; common very fine and fine and few medium tubular pores; slightly effervescent; clear, wavy boundary.

C1—16 to 22 inches, pale-brown (10YR 6/3) light silty clay, brown (10YR 5/3) moist; moderate, medium, blocky structure; very hard, firm, very sticky and plastic; few very fine and fine roots; common very fine and fine and few medium tubular pores; strongly effervescent; gradual boundary.

C2ca—22 to 40 inches, pale-brown (10YR 6/3) light silty clay, brown (10YR 5/3) moist; weak, coarse, blocky structure; very hard, firm, very sticky and plastic; few very fine and fine roots; common very fine and fine and few medium tubular pores; strongly effervescent; few increasing to common fine and medium lime masses; clear, wavy boundary.

IIC3—40 to 50 inches, very gravelly sand.

Depth to calcareous material ranges from 10 to 14 inches. Depth to very gravelly sand ranges from 40 to 60 inches. Hue is 10YR or 2.5Y throughout. The dark-colored surface layer ranges from 7 to 10 inches in thickness. The Ap horizon is brown, grayish brown, and light olive brown. The A and B horizons range from 12 to 18 inches in combined thickness. The B2t horizon ranges from 50 to 60 percent clay and is dark brown, brown, and light olive brown. The Cca horizon has few to many lime masses.

**Sofia silty clay, 0 to 2 percent slopes (Sra).**—This nearly level soil is on high benches, fans, and terraces. The gently undulating slopes between level swales and troughs range from 75 to 200 feet long. The soil has the profile described as representative of the series. Included in mapping on fans are areas of soils that have a surface layer of silty clay loam.

Runoff is slow, and the hazard of erosion is slight. This soil is used for irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIs-2 dryland, IIs-1 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Sofia silty clay, gently undulating (Srb).**—This gently undulating soil is on high terraces. Slopes are 2 to 4 percent. The soil has a profile similar to the one described as representative of the series, but it is steeper.

Runoff is slow, and the hazard of erosion is slight. This soil is used for irrigated and dryfarmed crops, hay, wildlife, recreation, and range. Capability unit IIe-2 dryland, IIe-3 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

## Spearfish Series

The Spearfish series consists of shallow, rolling to very steep, well-drained soils on dissected sedimentary uplands. Slopes range from 8 to 50 percent. These soils formed in place in material weathered from red shale



and sandstone. Elevation ranges from 4,200 to 5,000 feet.

The native vegetation is mainly Hoods phlox, bluebunch wheatgrass, big sagebrush, needleandthread, and broom snakeweed. Annual precipitation is 12 to 14 inches, the average annual soil temperature is 47° to 49° F, and the frost-free period is 100 to 110 days.

In a representative profile the surface layer is reddish-brown loam about 3 inches thick. The underlying material is red silty clay loam. Platy shale is at a depth of about 15 inches.

Permeability is moderate, and available water capacity is very low. The effective rooting depth is about 15 inches. These soils are used for range, watershed, recreation, and winter game range.

Representative profile of Spearfish loam, in an area of Spearfish-Clapper complex, hilly, in grassland, 1,000 feet west and 100 feet south of the NE. corner sec. 10, T. 9 S., R. 29 E.

A1—0 to 3 inches, reddish-brown (2.5YR 5/4) heavy loam, reddish brown (2.5YR 4/4) moist; weak, medium, platy structure; slightly hard, friable, slightly sticky and slightly plastic; slightly effervescent; few angular limestone fragments of pebble size; clear, smooth boundary.

C1—3 to 10 inches, red (2.5YR 5/6) light silty clay loam, red (2.5YR 4/6) moist; weak, fine, blocky structure; hard, friable, sticky and plastic; strongly effervescent; clear, wavy boundary.

C2ca—10 to 15 inches, red (2.5YR 5/6) silty clay loam, red (2.5YR 4/6) moist; weak, fine, blocky structure; hard, friable, sticky and plastic; strongly effervescent; few segregated lime threads and masses; gradual, wavy boundary.

C3—15 to 21 inches, red (2.5YR 5/6) platy shale.

Depth to bedrock ranges from 10 to 20 inches. The soil is loam or silty clay loam throughout. It ranges from 0 to 15 percent coarse fragments of red shale and pink or white limestone. Hue ranges from 2.5YR to 10R throughout. The A1 horizon is reddish brown and weak red. The C horizon is light red, red, and pale red.

**Spearfish-Clapper complex, hilly (SSa).**—This complex is made up of hilly and steep soils in the sedimentary uplands. It is 45 to 60 percent Spearfish loam and 35 to 50 percent Clapper gravelly and cobbly loam. Slopes are 15 to 35 percent. The Spearfish soil is on the lower sides of valleys and narrow drainageways. Fragments of pebble size are common on the surface. The Clapper soil is on valley rims, ridges between valleys, and the upper sides of valleys. It has slopes of mostly 25 to 35 percent. The Spearfish soil in this complex has the profile described as representative of the Spearfish series. The Clapper soil has a profile similar to the one described as representative of the Clapper series, but it is steeper. Coarse fragments in the Clapper soil are mainly limestone, and in places the soil is reddish brown and light reddish brown. Included in mapping are spots of Chugter loam on the valley bottoms.

Runoff is rapid, and the hazard of erosion is severe. These soils are used for range, wildlife, watershed, and recreation. Capability unit VIe-1 dryland; Shallow range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

**Spearfish-Rock outcrop complex, very steep (SSb).**—This complex is made up of steep and very steep soils in the sedimentary uplands. It is 35 to 45 percent

Spearfish loam, 15 to 30 percent Rock outcrop, 15 to 20 percent Pultney loam, and 5 to 35 percent Travessilla channery loam and sandy loam. Slopes are 35 to 90 percent. The soils are intermixed. They have sandstone, limestone, and shale fragments of channer and cobble size on the surface. Rock outcrop in this complex consists of red, pink, gray, brown, and reddish-brown limestone, dolomite, chert, sandstone, and shale that have slopes of 50 to 90 percent. The Spearfish soil in this complex has a profile similar to the one described as representative of the Spearfish series, but it is steeper. Included in mapping are areas of silty clay loam soils.

Runoff is rapid, and the hazard of erosion is severe. These soils are used for range, recreation, watershed, and game range. Capability unit VIIe-1 dryland; Thin Breaks range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

**Spearfish-Pultney association, rolling (SSc).**—This association is made up of rolling and hilly soils in the sedimentary uplands. It is about 55 percent Spearfish loam, 30 percent Pultney loam, and 10 percent La Fonda loam. Slopes are 8 to 25 percent. The La Fonda soil is on the lower sides and in the bottoms of wide drainageways. The Pultney soil is on ridgetops and above limestone ledges. The Spearfish and Pultney soils in this association have profiles similar to the ones described as representative of their respective series, but they are steeper. Channery fragments and fragments of gravel size cover 5 to 20 percent of the surface of all the soils in this mapping unit. Included in mapping are areas of Spearfish soils that have a surface layer of silty clay loam.

Runoff is rapid, and the hazard of erosion is severe. These soils are used for range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Shallow range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

**Spearfish-Pultney association, hilly (SSd).**—This association is made up of hilly and very steep soils in the sedimentary uplands. It is about 60 percent Spearfish loam, 20 percent Pultney loam, and 20 percent La Fonda loam and Rock outcrop. Slopes are mostly 15 to 35 percent, but they range to 50 percent. The Spearfish soil is mainly on valley sides where slopes range from 25 to 50 percent. The Pultney soil is on ridgetops and in narrow valleys. The La Fonda soil is on foot slopes at the heads of valleys. The Pultney soil in this association has a profile similar to the one described as representative of the Pultney series, but it is steeper. Included in mapping are areas of Spearfish soils that have a surface layer of silty clay loam.

Runoff is rapid, and the hazard of erosion is severe. These soils are used for range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Thin Hilly range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

## Spearman Series

The Spearman series consists of moderately deep, undulating and rolling, well-drained soils on dissected sedimentary uplands. Slopes range from 4 to 15 percent. These soils formed in place in material weathered



from platy, red, burned shale and sandstone. Elevation ranges from 3,500 to 4,000 feet.

The native vegetation is mainly needleandthread, western wheatgrass, big sagebrush, and broom snake-weed. Annual precipitation is 12 to 14 inches, the average annual soil temperature is 48° to 49° F, and the frost-free period is 105 to 110 days.

In a representative profile the surface layer is reddish-brown loam and clay loam about 4 inches thick. The subsoil is reddish-brown clay loam about 11 inches thick. The substratum is light reddish-brown channery loam. Fragmented hard shale is at a depth of about 23 inches, and hard shale or sandstone is at a depth of 25 inches.

Permeability is moderate, and available water capacity is low. The effective rooting depth is about 30 inches. These soils are used for range, wildlife, recreation, watershed, and dryfarmed crops.

Representative profile of Spearman loam, undulating, in grassland, 900 feet east and 1,000 feet north of the SW. corner sec. 1, T. 1 S., R. 37 E.

A11—0 to 2 inches, reddish-brown (5YR 5/3) heavy loam, dark reddish brown (5YR 3/3) moist; moderate, thin, platy structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine interstitial pores; clear, smooth boundary.

A12—2 to 4 inches, reddish-brown (5YR 5/3) light clay loam, dark reddish brown (5YR 3/3) moist; weak, medium, prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine and fine tubular pores; clear, wavy boundary.

B2—4 to 15 inches, reddish-brown (5YR 5/4) light clay loam, dark reddish brown (5YR 3/4) moist; moderate, medium, prismatic structure parting to moderate, medium, blocky; hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine and few fine tubular pores; few burned shale fragments; gradual, wavy boundary.

C1—15 to 19 inches, light reddish-brown (5YR 6/4) channery loam, yellowish red (5YR 4/6) moist; weak, fine, blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine roots; common very fine and few fine tubular pores; 15 percent flat, burned shale fragments; clear, wavy boundary.

C2—19 to 23 inches, light reddish-brown (5YR 6/6) channery loam, yellowish red (5YR 4/6) moist; massive; hard, friable, slightly sticky and slightly plastic; many very fine roots; common very fine and few fine tubular pores; 30 percent flat, burned shale fragments; strongly effervescent; lime crusts on bottoms of shale fragments; abrupt, wavy boundary.

C3—23 to 25 inches, fragmented, hard, red, burned shale; roots matted between shale layers.

R—25 inches, hard shale or sandstone.

Depth to platy shale and sandstone ranges from 20 to 40 inches. Hue ranges from 7.5YR to 10R throughout. The A and B horizons range from 2 to 10 percent shale fragments, and the C horizon, from 10 to 35 percent. The A horizon is weak red, reddish brown, dark reddish brown, and brown. The B2 horizon is reddish brown, dark reddish brown, yellowish red, red, and light red. The B2 and C1 horizons range from 20 to 30 percent clay.

**Spearman loam, undulating (St).**—This soil is in 10- to 30-acre areas on wide ridges in the burned shale highlands. Slopes are 4 to 8 percent. The soil has the profile described as representative of the series. Included in mapping are areas of Cushman loam, Thedalund loam, and Wibaux channery loam along ridgetops.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for dryfarmed crops, hay, wildlife, recreation, watershed, and range. The included spots of Wibaux soils interfere with tillage. Capability unit IIIe-3 dryland; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 2M.

**Spearman-Wibaux complex, rolling (SU).**—This complex is made up of undulating and rolling soils in the sedimentary uplands. It is 40 to 60 percent Spearman loam, 30 to 50 percent Wibaux loam and Wibaux stony loam, and 5 to 20 percent Thedalund loam. Slopes are mostly 8 to 15 percent, but they range to 4 percent. The Spearman soil is in swales between hills, on wide ridges, and at the heads of drainageways. The Wibaux soils are around and on low knolls, narrow ridges, and side slopes. The Thedalund soil is on the highest hill-tops. Included in mapping with the Wibaux soils in places are ledges of sandstone and some porcelanite boulders.

Runoff is rapid, and the hazard of erosion is severe. These soils are used for wildlife, recreation, watershed, range, hay, pasture, and dryfarmed crops. Capability unit IVE-3 dryland; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 3M.

## Splitro Series

The Splitro series consists of shallow, steep and rolling and hilly, well-drained soils on hills and ridges in the sedimentary uplands. Slopes range from 8 to 35 percent. These soils formed in place in material weathered from noncalcareous sandstone. Elevation ranges from 4,800 to 6,000 feet.

The native vegetation is mainly dryland sedges, big sagebrush, wild geranium, Idaho fescue, Douglas-fir, and limber pine. Annual precipitation is 18 to 20 inches, the average annual soil temperature is 45° to 46° F, and the frost-free period is 70 to 85 days.

In a representative profile the surface layer is dark-brown sandy loam about 3 inches thick. The subsoil is dark-brown sandy loam about 6 inches thick. The underlying material is brown sandy loam. Hard sandstone is at a depth of about 13 inches.

Permeability is moderately rapid, and available water capacity is very low. The effective rooting depth is about 15 inches. These soils are used for range, recreation, watershed, and game range.

Representative profile of Splitro sandy loam, in an area of Splitro-Sawcreek sandy loams, rolling, in grassland, 1,320 feet south and 1,320 feet west of the NE. corner sec. 17, T. 7 S., R. 26 E.

A1—0 to 3 inches, dark-brown (10YR 4/3) light sandy loam, very dark grayish brown (10YR 3/2) moist; weak, medium, granular structure; soft, very friable, nonsticky and nonplastic; many fine and very fine roots; clear, smooth boundary.

B2—3 to 9 inches, dark-brown (10YR 4/3) sandy loam, dark brown (10YR 3/3) moist; weak, coarse, prismatic structure; slightly hard, friable, nonsticky and slightly plastic; few medium and common very fine roots; few very fine pores; few fine sandstone fragments; gradual, wavy boundary.

C—9 to 13 inches, brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; weak, medium, blocky structure; slightly hard, friable, nonsticky and slightly plastic; common very fine roots; many



very fine pores; few fine sandstone fragments; abrupt, wavy boundary.

R—13 to 15 inches, hard, noncalcareous sandstone.

Depth to bedrock ranges from 10 to 20 inches. The soil ranges from 5 to 30 percent coarse fragments. Hue is 10YR or 7.5YR throughout. The dark-colored surface layer ranges from 6 to 10 inches in thickness. The B2 horizon is dark brown, brown, and grayish brown.

**Splitro-Sawcreek sandy loams, rolling (SVa).**—This complex is made up of rolling soils on ridges and hillsides at the heads of deep drainageways. It is about 55 percent Splitro sandy loam, 35 percent Sawcreek sandy loam, and 10 percent Rock outcrop. Slopes are 8 to 15 percent. Relief ranges from 35 to 125 feet. Slopes range from 50 to 250 feet long. The soils occur in no definite pattern, but the Sawcreek soil is below the low rock ledges and on the sides and bottoms of drainageways. The areas of bare rock are typically surrounded by the Splitro soil. The Splitro and Sawcreek soils in this complex have the profiles described as representative of their respective series.

Runoff is medium, and the hazard of erosion is moderate. These soils are used for range, watershed, recreation, and game range. Capability unit VIe-1 dryland; Sandy range site, 20- to 24-inch precipitation zone; windbreak suitability group 3M.

**Splitro-Sawcreek sandy loams, hilly (SVb).**—This complex is made up of hilly soils on ridges and hills. It is 40 to 55 percent Splitro sandy loam, 20 to 30 percent Sawcreek sandy loam, 15 to 20 percent Rock outcrop, and as much as 25 percent Teton loam and Adel loam. Slopes are mostly 15 to 25 percent, but they range to 35 percent. Sandstone ledges, 5 to 20 feet high, make sharp slope breaks on the hillsides and ridges. Relief ranges from 75 to 200 feet. The Sawcreek, Teton, and Adel soils are on 12 to 30 percent slopes below the sandstone ledges. The Splitro soil is about the rock ledges and around areas of Rock outcrop. Slopes are 15 percent on ridgetops and 25 to 35 percent along the rock ledges. The Splitro and Sawcreek soils in this complex have profiles similar to the ones described as representative of their respective series, but they are steeper.

Runoff is rapid, and the hazard of erosion is severe. These soils are used for range, watershed, recreation, and game range. Capability unit VIe-1 dryland; Sandy range site, 20- to 24-inch precipitation zone; windbreak suitability group 4.

### Stormitt Series

The Stormitt series consists of deep, well-drained, nearly level to steep and hilly soils on fans, foot slopes, and benches. Slopes range from 0 to 35 percent. These soils formed in gravelly and cobbly alluvium derived from mixed limestone, quartzite, and shale rock. Elevation ranges from 4,000 to 4,900 feet.

The native vegetation is mainly Hoods phlox, big sagebrush, black sagebrush, dryland sedges, blue grama, and prairie junegrass. Annual precipitation is 10 to 12 inches, the average annual soil temperature is 47° to 49° F, and the frost-free period is 100 to 110 days.

In a representative profile the surface layer is brown loam about 4 inches thick. The subsoil is light-brown loam about 3 inches thick. The substratum is light-brown loam that grades to pink gravelly loam and very gravelly loam that extends to a depth of 60 inches or more. About half of the substratum, by volume, is limestone, chert, and siltstone fragments of gravel and cobble size.

Permeability and available water capacity are moderate. The effective rooting depth is 50 inches or more. These soils are used for range, wildlife, recreation, and watershed.

Representative profile of Stormitt loam, in an area of Stormitt complex, 0 to 4 percent slopes, in grassland, 100 feet west and 100 feet south of the NE. corner sec. 9, T. 7 S., R. 25 E.

A11—0 to 1 inch, brown (7.5YR 5/2) loam, dark brown (7.5YR 3/2) moist; weak, very fine, granular structure; soft, very friable, nonsticky and slightly plastic; 7 percent (volume) limestone and chert fragments of pebble size; clear, smooth boundary.

A12—1 inch to 4 inches, brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; weak, medium, platy structure; slightly hard, friable, nonsticky and slightly plastic; 5 percent (volume) limestone and chert fragments of pebble size; clear, smooth boundary.

B—4 to 7 inches, light-brown (7.5YR 6/4) loam, brown (7.5YR 5/4) moist; moderate, coarse, prismatic structure; hard, friable, slightly sticky and slightly plastic; 5 percent (volume) limestone and chert fragments of pebble size; slightly effervescent; clear, wavy boundary.

C1—7 to 10 inches, light-brown (7.5YR 6/4) loam, brown (7.5YR 5/4) moist; weak, coarse, prismatic structure; hard, friable, sticky and plastic; 10 percent (volume) limestone and chert fragments of pebble size; strongly effervescent; lime casts on pebbles; gradual, wavy boundary.

C2ca—10 to 17 inches, pink (7.5YR 7/4) gravelly loam, light brown (7.5YR 6/4) moist; massive; hard, friable, slightly sticky and slightly plastic; 30 percent (volume) limestone and chert fragments of pebble size; violently effervescent; lime casts on pebbles.

C3—17 to 24 inches, pink (7.5YR 7/4) very gravelly loam, light brown (7.5YR 6/4) moist; massive; hard, friable, slightly sticky and slightly plastic; 50 percent (volume) limestone and siltstone fragments of pebble and cobble size; violently effervescent; lime casts on pebbles and cobbles; diffuse boundary.

C4—24 to 42 inches, pink (5YR 7/4) very gravelly loam, light reddish brown (5YR 6/4) moist; massive; soft, very friable, nonsticky and nonplastic; violently effervescent; 60 percent (volume) limestone and siltstone fragments of pebble and cobble size.

C5—42 to 60 inches, very gravelly loam.

Content of pebbles, cobbles, and stones increases with increasing depth and averages 35 to 60 percent (volume) between depths of 10 and 40 inches. Hue ranges from 10YR to 5YR throughout. The A horizon is grayish-brown, light-brown, and brown loam or gravelly loam. The Cca horizon is pink, very pale brown, and pinkish gray. It has a 30- to 45-percent calcium carbonate equivalent.

**Stormitt extremely stony loam, hilly (Swa).**—This strongly sloping to steep and hilly soil is on 1- to 2-mile long fans. These fans are crossed by drainageways, 50 to 100 feet deep, at 1/2- to 3/4-mile intervals. Slopes are mostly 15 to 35 percent, but they range to 8 percent. They are 12 to 20 percent at the base of the



mountain front, 8 to 15 percent at the lower ends of the fans, and 35 percent on the sides of the major drainageways. The soil has a profile similar to the one described as representative of the series, but it is steeper, and stones and boulders cover 10 to 50 percent of the surface.

Included with this soil in mapping are areas of soils that have a surface layer of bouldery loam and spots of Harvey loam that has gravel scattered on the surface.

Runoff is rapid, and the hazard of erosion is severe. This soil is used for range, wildlife, recreation, and watershed. Capability unit VII<sub>s</sub>-1 dryland; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 3L.

**Stormitt complex, 0 to 4 percent slopes (Swb).**—This complex is made up of nearly level and gently undulating soils on fans and benches. It is 50 to 65 percent Stormitt gravelly loam and 35 to 50 percent Stormitt loam. It is mainly along the braided channels where surface gravel is common. The Stormitt loam soils in this complex has the profile described as representative of the Stormitt series. The Stormitt gravelly loam soil has a profile similar to the one described as representative of the Stormitt series, but the surface layer is gravelly loam.

Runoff is slow, and the hazard of erosion is severe. Spring flooding occurs in localized areas. These soils are used for range, wildlife, recreation, watershed, hay, and pasture. Capability unit IV<sub>s</sub>-2 dryland; Shallow to Gravel range site, 10- to 14-inch precipitation zone; windbreak suitability group 3M.

**Stormitt complex, 4 to 15 percent slopes (SX).**—This complex is made up of sloping and strongly sloping soils on fans and foot slopes. It is about 55 percent Stormitt loam and Stormitt gravelly loam, 35 percent Haverson loam, and 10 percent La Fonda loam. The Stormitt soils are on fans and foot slopes. The Haverson soil is on flood plains. The La Fonda soil is on fans that have no surface gravel. The Stormitt and Haverson soils in this complex have profiles similar to the ones described as representative of their respective series, but they are steeper, and the Stormitt loam soil has a surface layer of loam.

Runoff is medium, and the hazard of erosion is moderate. These soils are used for watershed, recreation, wildlife, range, hay, and pasture. Capability unit IV<sub>s</sub>-2 dryland; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 3M.

## Talag Series

The Talag series consists of deep, nearly level to gently sloping, well-drained, sodium-affected soils on fans, terraces, and foot slopes. Slopes range from 0 to 8 percent. These soils formed in deep, calcareous clay loam alluvium. Elevation ranges from 3,000 to 3,700 feet.

The native vegetation is mainly western wheatgrass, blue grama, cudweed, sagewort, silver sagebrush, and prairie junegrass. Annual precipitation is 13 to 14 inches, the average annual soil temperature is 48° to 50° F, and the frost-free period is 110 to 125 days.

In a representative profile the surface layer is light brownish-gray loam about 3 inches thick. The next layer is grayish-brown clay about 2 inches thick. The subsoil is dark-brown and light olive-brown clay about 17 inches thick. The substratum is grayish-brown stratified clay loam and silty clay loam that extends to a depth of 60 inches or more.

Permeability is very slow, and available water capacity is high. The effective rooting depth is 60 inches or more. These soils are used for range, wildlife, recreation, and watershed.

Representative profile of Talag clay, 0 to 8 percent slopes, in grassland, 720 feet north and 1,000 feet east of the SW. corner sec. 24, T. 4 S., R. 28 E.

A2—0 to 3 inches, light brownish-gray (10YR 6/2) loam, very dark grayish brown (10YR 3/2) moist; moderate, thin, platy structure; slightly hard, very friable, nonsticky and nonplastic; common very fine roots; few fine and medium and common very fine tubular pores; plates coated with unstained silt and fine sand; clear, smooth boundary.

B&A—3 to 5 inches, grayish-brown (10YR 5/2) clay coated with light brownish-gray (10YR 6/2) uncoated silt and sand, dark grayish brown (10YR 4/2) moist; moderate, medium, prismatic structure parting to strong, medium, platy; hard, friable, sticky and plastic; common very fine roots; few fine and medium and common very fine tubular pores; thin, patchy clay films on peds; clear, wavy boundary.

B21t—5 to 13 inches, dark-brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; strong, medium, prismatic structure parting to strong, medium, blocky; very hard, very firm, very sticky and very plastic; few very fine roots; common very fine tubular pores; continuous, thin clay films that have a value of 2 dry or moist on peds; clear, wavy boundary.

B22t—13 to 18 inches, light olive-brown (2.5Y 5/4) clay; olive brown (2.5Y 4/4) moist; moderate, coarse, prismatic structure parting to strong, medium, blocky; very hard, very firm, very sticky and very plastic; few very fine roots; few fine and common very fine tubular pores; patchy clay films on peds; clear, wavy boundary.

B3—18 to 22 inches, light olive-brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) moist; moderate, coarse, prismatic structure parting to moderate, medium, blocky; very hard, firm, very sticky and very plastic; few very fine roots; few fine and common very fine tubular pores; thin, patchy clay films on peds; slightly effervescent; few lime threads; gradual, wavy boundary.

C1ca—22 to 31 inches, grayish-brown (2.5Y 5/2) heavy clay loam, dark grayish brown (2.5Y 4/2) moist; medium, blocky structure; very hard, firm, sticky and plastic; few very fine roots; few fine and common very fine tubular pores; strongly effervescent; common threads and masses of lime; gradual, wavy boundary.

C2—31 to 60 inches, grayish-brown (2.5Y 5/2) stratified clay loam and silty clay loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, firm, sticky and plastic; few roots; common very fine tubular pores; few hard shale and sandstone fragments; strongly effervescent; lime coatings on shale and sandstone fragments.

The A2 horizon is light brownish gray and grayish brown in hue of 2.5Y or 10YR and chroma of 2 or 3. The A&B or B&A horizon ranges from silty clay loam to clay loam. The B2t horizon ranges from 50 to 60 percent clay. It is dark brown, light olive brown, and brown. It is 5 to 10 percent exchangeable sodium in the upper part, and 10 to 20 percent in the lower part.

**Talag clay, 0 to 8 percent slopes (Taa).**—This soil is on terraces and fans. Areas range from 10 to 15 acres



in size. Slopes are mostly 1 to 3 percent, but they are 7 to 8 percent along terrace breaks and on fans or at the bases of hills. The soil has the profile described as representative of the series. Included in mapping are spots of Allentine clay, which has a thin cover of plants.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for range, wildlife, recreation, and watershed. Capability unit VIs-1 dryland; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 3S.

#### **Talag-Allentine complex, 0 to 4 percent slopes (Tab).**

—This complex is made up of nearly level and gently sloping soils on terraces and fans. It is 75 to 85 percent Talag silty clay loam and 15 to 25 percent Allentine clay. Areas range from 10 to 30 acres in size. The thin cover of stunted plants marks the Allentine soil in areas of range, and the surface clods identify it in cultivated fields. The Talag soil in this complex has a profile similar to the one described as representative of the Talag series, but the surface layer is silty clay loam. The Allentine soil has the profile described as representative of the Allentine series.

Runoff is slow, and the hazard of erosion is slight. These soils are used for range, wildlife, recreation, and watershed. Capability unit VIs-1 dryland; Pan Spots range site, 10- to 14-inch precipitation zone; windbreak suitability group 3S.

### **Tarrete Series**

The Tarrete series consists of moderately deep, strongly sloping to steep and rolling to hilly, well-drained soils in the sedimentary highlands. Slopes range from 8 to 35 percent. These soils formed in material weathered in place from red clay shale. Elevation ranges from 5,800 to 7,000 feet.

The native vegetation is mainly cinquefoil, green needlegrass, Douglas-fir, rough fescue, and big sagebrush. Annual precipitation is 18 to 22 inches, the average annual soil temperature is 42° to 45° F, and the frost-free period is 60 to 75 days.

In a representative profile the surface layer is dark reddish-brown loam about 4 inches thick. The subsoil is red and light-red silty clay and clay about 19 inches thick. The substratum is light-red clay that extends to a depth of about 60 inches. A few chert and limestone fragments of gravel size occur throughout the soil.

Permeability is slow, and available water capacity is high. The effective rooting depth is 60 inches or more. These soils are used for grazing, watershed, recreation, and game range.

Representative profile of Tarrete silty clay loam, in an area of Duncom-Tarrete association, rolling, in grassland, 2,000 feet south and 500 feet east of the NW. corner sec. 24, T. 9 S., R. 30 E.

A1—0 to 4 inches, dark reddish-brown (2.5YR 3/4) loam, dark reddish brown (2.5YR 2/4) moist; strong, coarse, granular structure; slightly hard, friable slightly sticky and slightly plastic; common fine and very fine roots; few fine chert fragments of pebble size; clear, smooth boundary.

B21—4 to 7 inches, red (10R 5/6) silty clay, red (10R 4/6) moist; moderate, fine, blocky structure; very hard,

firm, very sticky and very plastic; common fine and very fine roots; thin, patchy clay films on peds; few chert fragments of pebble size; very slightly effervescent; clear, wavy boundary.

B22ca—7 to 15 inches, red (10R 5/6) clay, red (10R 4/6) moist; weak, medium, prismatic structure parting to moderate, fine, blocky; very hard, very firm, very sticky and very plastic; common very fine roots; few chert fragments of pebble size; strongly effervescent; few fine lime threads; clear, wavy boundary.

B3ca—15 to 23 inches, light-red (10R 6/6) clay, red (10R 5/6) moist; moderate, fine, blocky structure; extremely hard, very firm, very sticky and very plastic; few very fine roots; few fine limestone and chert fragments of pebble size; strongly effervescent; common lime threads; diffuse, wavy boundary.

C1—23 to 35 inches, light-red (10R 6/6) clay, red (10R 5/6) moist; strong, medium and coarse, blocky structure; extremely hard, very firm, very sticky and very plastic; few very fine roots; strongly effervescent; common fine lime threads and few medium lime masses; gradual, wavy boundary.

C2—35 to 60 inches, light-red (10R 6/6) clay, red (10R 5/6) moist; massive; extremely hard, very firm, very sticky and very plastic; strongly effervescent.

Depth to calcareous material ranges from 5 to 10 inches. The soil between depths of 10 and 40 inches is 60 to 75 percent clay. The soil ranges from 0 to 10 percent coarse fragments of limestone and chert. Hue ranges from 5YR to 10R throughout. The A horizon is dark reddish brown, reddish brown, dusky red, and weak red. The B and C horizons are light red, light reddish brown, and pale red.

#### **Tarrete silty clay loam, 8 to 15 percent slopes (Tb).—**

This strongly sloping soil is on hillsides and side slopes of ridges and in the heads of valleys. The areas are marked by a thick cover of cinquefoil and grasses. The soil has a profile similar to the one described as representative of the series, but a few relict, bluish-gray and greenish-gray mottles are below a depth of 30 inches.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for range, pasture, recreation, watershed, and game range. Capability unit IVE-2 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 2M.

### **Terrace Escarpments**

Two units of Terrace escarpments are mapped in this Area. They are described in the following paragraphs.

**Terrace escarpments, gravelly (TCa).—**This land type is on steep, eroded edges of gravelly terraces. Areas are irregularly shaped. Local relief ranges from 30 to 75 feet. Areas are 700 or 800 feet wide where short drainageways cut into the main body of the terrace. Beds of very gravelly sand and very gravelly loam, 5 to 25 feet thick, cover nearly all the land surface. Shale outcrop occurs in places on the lower parts of escarpments and deep drainageways. In most places slopes are stable, and a surface layer of grayish-brown gravelly loam or sandy loam 2 to 6 inches thick covers the loose sand and gravel.

Runoff is rapid, and the hazard of erosion is moderate. This land type is used for range, watershed, wildlife, and recreation. It is a source of gravel for road and masonry construction. Capability unit VIIIs-1



dryland; Shallow to Gravel range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

**Terrace escarpments, loamy (TCb).**—This land type is on steep, eroded edges of fans, terraces, and foot slopes. Areas are 100 to 500 feet wide, and they typically separate soils on the main parts of the fans and terraces from soils on the flood plains. Where the valley bottoms are narrow, soils on the flood plains are included with this land type in mapping. Erosion is active. Slopes are short and uneven. Local relief is 15 to 30 feet. Slopes range from 8 to 50 percent and average 15 to 25 percent. The material ranges from clay loam to fine sandy loam and is commonly stratified.

Runoff is rapid, and the hazard of erosion is severe. This land type is used for range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Thin Hilly range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

### Terry Series

The Terry series consists of moderately deep, undulating, well-drained soils on ridges and hills in the sandstone uplands. Slopes are mostly 4 to 8 percent, but they range to 2 percent. These soils formed in material weathered in place from calcareous sandstone. Elevation ranges from 3,000 to 3,800 feet.

The native vegetation is mainly needleandthread, big sagebrush, western wheatgrass. Hood's phlox, and plains pricklypear. Annual precipitation is 13 to 14 inches, the average annual soil temperature is 47° to 49° F, and the frost-free period is 110 to 125 days.

In a representative profile the surface layer is brown sandy loam about 2 inches thick. The subsoil is brown sandy loam and sandy clay loam about 10 inches thick. The substratum is light yellowish-brown and pale-brown sandy loam. Sandstone is at a depth of about 25 inches.

Permeability is rapid, and available water capacity is low. The effective rooting depth is about 25 inches. These soils are used for range, wildlife, recreation, watershed, and dryfarmed crops.

Representative profile of Terry sandy loam, in an area of Terry-Travessilla sandy loams, undulating, in grassland, 1,320 feet north and 100 feet west of the SE. corner sec. 34, T. 8 S., R. 29 E.

- A—0 to 2 inches, brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; weak, granular structure; soft, very friable, nonsticky and slightly plastic; clear, smooth boundary.
- B1—2 to 5 inches, brown (10YR 5/3) heavy sandy loam, dark brown (10YR 4/3) moist; weak, coarse, blocky structure; slightly hard, friable, nonsticky and slightly plastic; gradual, smooth boundary.
- B2t—5 to 12 inches, brown (10YR 5/3) light sandy clay loam, dark brown (10YR 4/3) moist; weak, coarse, prismatic structure; hard, friable, slightly sticky and plastic; oriented clay films bridging sand grains; clear, smooth boundary.
- C1ca—12 to 19 inches, light yellowish-brown (10YR 6/4) heavy sandy loam, dark brown (10YR 4/4) moist; weak, coarse, blocky structure; hard, friable, nonsticky and slightly plastic; flat sandstone fragments; strongly effervescent; gradual, wavy boundary.
- C2—19 to 25 inches, pale-brown (10YR 6/3) sandy loam,

brown (10YR 5/4) moist; massive; hard, friable, nonsticky and slightly plastic; 25 percent (volume) flat sandstone fragments; strongly effervescent; abrupt, wavy boundary.

R—25 inches, hard, variegated sandstone.

Depth to calcareous material ranges from 10 to 15 inches, and depth to bedrock, from 20 to 40 inches. The soil ranges from 0 to 25 percent coarse fragments throughout. Hue is 2.5Y or 10YR throughout. The A and B horizons range from 10 to 18 inches in combined thickness. The A horizon is brown and grayish brown. The B2t horizon is brown and dark-brown sandy loam and light sandy clay loam. The C horizon is light brownish gray, pale brown, and light yellowish brown.

**Terry fine sandy loam, undulating (Td).**—This undulating soil is on low ridges and in concave areas between broad drainage divides in the sandstone uplands. Slopes are mostly 4 to 8 percent, but they range to 2 percent. Local relief is 10 to 25 feet.

Included with this soil in mapping are areas of Nelson fine sandy loam and a few low sandstone ledges on the south sides of the ridges.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for dryfarmed crops, pasture, wildlife, recreation, watershed, and range. Capability unit IVe-3 dryland; Sandy range site, 10- to 14-inch precipitation zone; windbreak suitability group 2M.

**Terry-Travessilla sandy loams, undulating (TE).**—This complex is made up of undulating soils on sandstone uplands that are dissected by shallow drainage ways. It is about 45 percent Terry sandy loam, 35 percent Travessilla sandy loam and Travessilla chanery sandy loam, and 15 percent Rock outcrop. Slopes are mostly 4 to 8 percent, but they range to 2 percent. The soils are intermixed, but the Travessilla soils are around areas of Rock outcrop and areas that have surface channers. The surface of Rock outcrop is typically 8 to 12 inches below the level of the surrounding soils. The Terry soil in this complex has the profile described as representative of the Terry series. Included in mapping are spots of soils that range to reddish brown and light reddish brown.

Runoff is slow, and the hazard of soil blowing is moderate. These soils are used for range, wildlife, recreation, and watershed. Capability unit VIIs-1 dryland; Sandy range site, 10- to 14-inch precipitation zone; windbreak suitability group 3M.

### Teton Series

The Teton series consists of moderately deep, strongly sloping to steep, well-drained soils on bedrock uplands and mountainsides. Slopes range from 8 to 45 percent. These soils formed in material weathered in place from sandstone. Elevation ranges from 4,000 to 5,500 feet.

The native vegetation is mainly big sagebrush, wild geranium, green needlegrass, Idaho fescue, and bluegrass. Annual precipitation is 20 to 22 inches, the average annual soil temperature is 43° to 45° F, and the frost-free period is 60 to 85 days.

In a representative profile the surface layer is very dark grayish-brown loam about 3 inches thick. The subsoil is dark grayish-brown and grayish-brown loam about 21 inches thick. The substratum is pale-brown



loam that contains scattered coarse sandstone fragments. Sandstone is at a depth of about 29 inches.

Permeability is moderate, and available water capacity is low or moderate. The effective rooting depth is about 30 inches. These soils are used for range, recreation, watershed, and game range.

Representative profile of Teton loam, 8 to 25 percent slopes, in grassland, 1,200 feet south and 1,320 feet east of the NW. corner sec. 16, T. 6 S., R. 25 E.

- A1—0 to 3 inches, very dark grayish-brown (10YR 3/2) loam, very dark brown (10YR 2/2) moist; weak, coarse, platy structure; soft, very friable, slightly sticky and slightly plastic; clear, smooth boundary.
- B1—3 to 9 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak, medium, prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; clear, wavy boundary.
- B21—9 to 16 inches, dark grayish-brown (10YR 4/2) loam, dark brown (10YR 3/3) moist; weak, medium, prismatic structure parting to moderate, medium, blocky; hard, friable, sticky and plastic; clear, wavy boundary.
- B3—16 to 24 inches, grayish-brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak, medium, prismatic structure parting to moderate, medium, blocky; hard, friable, slightly sticky and plastic; clear, wavy boundary.
- C—24 to 29 inches, pale-brown (10YR 6/3) loam, brown (10YR 4/3) moist; massive; hard, friable, slightly sticky and plastic; abrupt, wavy boundary.
- R—29 to 33 inches, sandstone.

Depth to bedrock ranges from 20 to 40 inches. Hue is 10YR or 7.5YR throughout. The A and B horizons range from 0 to 15 percent coarse fragments, and the C horizon, from 10 to 35 percent. The dark-colored surface layer ranges from 9 to 16 inches in thickness. The A1 and B2 horizons are very dark grayish brown, dark grayish brown, and brown. The B horizon is heavy loam or light clay loam. The C horizon is moderately calcareous or noncalcareous.

**Teton loam, 8 to 25 percent slopes (TFa).**—This soil is on side slopes of canyons that are 150 to 250 feet deep. Low sandstone ledges crop out along the rims and on the lower side slopes. The soil has the profile described as representative of the series.

Included with this soil in mapping are areas of Rock outcrop, Splitro sandy loam, and Mayflower silty clay loam. These included soils make up 15 to 25 percent of the total area of this mapping unit.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for range, wildlife, recreation, watershed, and pasture. Capability unit IVE-2 dryland; Silty range site, 20- to 24-inch precipitation zone; windbreak suitability group 2M.

**Teton complex, 25 to 45 percent slopes (TFb).**—This complex is made up of steep soils on the upper side slopes above the massive limestone rim of deep mountain canyons. It is about 40 percent Teton loam, 30 percent Mayflower silt loam, and 30 percent Duncom cobbly loam. The soils are in horizontal bands, but there is no predictable sequence in which they occur. The Teton soil in this complex has a profile similar to the one described as representative of the Teton series, but it is steeper.

Runoff is rapid, and the hazard of erosion is severe. These soils are used for range, recreation, watershed, and game range. Capability unit VIe-1 dryland; Silty

range site, 20- to 24-inch precipitation zone; windbreak suitability group 4.

## Thedalund Series

The Thedalund series consists of moderately deep, undulating to very steep, well-drained soils in the sedimentary uplands. Slopes range from 4 to 90 percent. These soils formed in material weathered in place from shale. Elevation ranges from 2,800 to 3,800 feet.

The native vegetation is mainly western wheatgrass, needleandthread, side-oats grama, dryland sedges, and big sagebrush. Annual precipitation is 12 to 14 inches, the average annual soil temperature is 48° to 50° F, and the frost-free period is 105 to 125 days.

In a representative profile the surface layer is grayish-brown loam about 2 inches thick. The underlying material is light olive-brown, light yellowish-brown, and light-gray loam. Loam shale is at a depth of about 28 inches.

Permeability is moderate, and available water capacity is low or moderate. The effective rooting depth is about 28 inches. Most of these soils are used for range, wildlife, recreation, and watershed. Small areas included with deeper soils are used for dryfarmed crops.

Representative profile of Thedalund loam, undulating, in grassland, 125 feet east of trail, 1,610 feet north and 1,400 feet east of the SW. corner sec. 14, T. 1 S., R. 35 E.

- A—0 to 2 inches, grayish-brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; weak, coarse, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots; slightly effervescent; clear, smooth boundary.
- C1—2 to 8 inches, light olive-brown (2.5Y 5/4) heavy loam, olive brown (2.5Y 4/4) moist; weak, coarse, prismatic structure; hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine pores; slightly effervescent; few fine lime threads and soft lime masses; gradual, wavy boundary.
- C2—8 to 14 inches, light yellowish-brown (2.5Y 6/4) heavy loam, olive brown (2.5Y 4/4) moist; weak, coarse, prismatic structure; hard, friable, slightly sticky and plastic; common very fine roots; common very fine pores; strongly effervescent; few fine, soft lime masses; gradual, wavy boundary.
- C3—14 to 22 inches, light yellowish-brown (2.5Y 6/4) loam, light olive brown (2.5Y 5/4) moist; massive; slightly hard, friable, slightly sticky and plastic; few very fine roots; common very fine pores; strongly effervescent; common fine, soft lime masses; gradual, wavy boundary.
- C4—22 to 28 inches, light-gray (5Y 7/2) loam, olive (5Y 5/3) moist; weak, thick, platy structure; slightly hard, friable, sticky and plastic; few very fine roots; common very fine pores; few shale and sandstone chips; strongly effervescent; common medium, soft lime masses; diffuse, smooth boundary.
- C5—28 to 37 inches, platy loam shale.

Between depths of 10 and 40 inches the soil is loam or light clay loam. The soil normally ranges from 0 to 20 percent coarse fragments, but it is as much as 35 percent in the more stony phase. The A horizon and the upper part of the C horizon have hue of 2.5Y and 10YR, and the lower part of the C horizon, 2.5Y and 5Y. The A horizon is grayish brown, brown, and dark grayish brown. The lower part of the C horizon is light olive brown, light yellowish brown, and pale olive.



**Thedalund loam, undulating (Tg).**—This undulating soil is on narrow ridges and hills in mixed shale and sandstone highlands. Slopes are mostly 4 to 8 percent. The soil has the profile described as representative of the series. Included in mapping are areas of soils that have a surface layer of very fine sandy loam.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIIe-2 dryland; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 2M.

**Thedalund-Clapper complex, hilly (THa).**—This complex is made up of hilly and steep soils in the gravelly sedimentary uplands. It is 40 to 70 percent Thedalund loam, 10 to 30 percent Clapper gravelly loam, 10 to 30 percent Midway silty clay loam, 5 to 15 percent Rock outcrop and Shale outcrop, and 5 to 10 percent McRae loam. Slopes are mostly 15 to 25 percent, but they range to 35 percent. The Thedalund and Midway soils are on ridges and valley sides where erosion has removed the gravelly capping. The Clapper soil is on terrace edges and on scattered knolls and ridges. The McRae soil is on the lower sides of the major valleys. Slopes are 20 to 35 percent on the Thedalund and McRae soils and 15 to 25 percent on the Clapper soil. The Clapper and Thedalund soils have profiles similar to the ones described as representative of their respective series, but they are steeper.

Runoff is rapid, and the hazard of erosion is severe. These soils are used for range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Thin Hilly range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

**Thedalund-Cushman loams, undulating (THb).**—This complex is made up of undulating soils in the sedimentary uplands. It is about 60 percent Thedalund loam and 40 percent Cushman loam. The Thedalund soil is on ridges and hills where slopes are 6 to 8 percent. The Cushman soil is in concave areas between ridges and hills and on ridgetops where slopes are 4 or 5 percent. Included in mapping are areas of soils that have a light-brown substratum.

Runoff is medium, and the hazard of erosion is moderate. These soils are suited to dryfarmed crops, hay, wildlife, recreation, watershed, and range. Cultivation exposes the erodible, limy substratum of the Thedalund soil. Capability unit IIIe-3 dryland; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 2M.

**Thedalund-Fort Collins complex, rolling (THc).**—This complex is made up of rolling soils in the sedimentary uplands. It is 25 to 40 percent Thedalund loam, 15 to 25 percent Midway silty clay loam, and 35 to 50 percent Fort Collins loam, Thurlow silty clay loam, and McRae loam. Slopes are 8 to 15 percent. The Thedalund and Midway soils are on the crests and sides of hills and ridges. The Fort Collins, Thurlow, and McRae soils are in valleys and tributary drainageways. Slopes range from 175 to 300 feet long. The Thedalund, Midway, and Fort Collins soils in this complex have profiles similar to the ones described as representative of their respective series, but the Thedalund and Fort Collins soils are steeper, and the Midway soil is less sloping. Included in mapping are iso-

lated, 5- to 15-acre knolls of Nelson and Travessilla sandy loams.

Runoff is medium, and the hazard of erosion is moderate. These soils are suited to wildlife, range, hay, and pasture. Capability unit IVe-3 dryland; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 2M.

**Thedalund-McRae loams, dissected (THd).**—This complex is made up of undulating to steep soils in the sedimentary uplands. It is 40 to 65 percent Thedalund loam, 30 to 50 percent McRae loam, and 5 to 15 percent Kim loam. Slopes are 4 to 35 percent. The Thedalund soil is in 2- to 10-acre patches on shale knolls and ridges where slopes are 8 to 25 percent. The McRae soil is on fans and foot slopes that surround or lie between patches of the Thedalund soil. The Kim soil is on the sides and edges of narrow gullies and coulees that are 5 to 15 feet deep. It has slopes of 20 to 35 percent. The Thedalund and McRae soils in this complex have profiles similar to the ones described as representative of their respective series, but they are steeper.

Runoff is rapid, and the hazard of erosion is severe. Most areas receive runoff from soils above them. These soils are suited to range, wildlife, recreation, watershed, and pasture. Capability unit IVe-3 dryland; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 2M.

**Thedalund-Midway complex, rolling (THe).**—This complex is made up of rolling soils in the sedimentary uplands. It is 40 to 70 percent Thedalund loam, 20 to 40 percent Midway silty clay loam, and 10 to 20 percent McRae loam. Slopes are 8 to 15 percent. The Thedalund and Midway soils are intermixed on hills and ridges. The McRae soil is in the shallow heads of drainageways and on narrow foot slopes in wide drainageways. The Thedalund and Midway soils in this complex have profiles similar to the ones described as representative of their respective series, but the Thedalund soil is steeper and the Midway soil is less sloping.

Runoff is medium, and the hazard of erosion is moderate. These soils are suited to range, wildlife, recreation, watershed, and pasture. Capability unit IVe-3 dryland; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 3M.

**Thedalund-Nelson complex, rolling (THf).**—This complex is made up of rolling soils in the sedimentary uplands. It is 40 to 60 percent Thedalund loam, 20 to 35 percent Nelson fine sandy loam, and 10 to 30 percent Glenberg, Alice, and Fort Collins soils. Slopes are 8 to 15 percent. The Thedalund and Nelson soils are intermixed. The Alice, Fort Collins, and Glenberg soils are at the heads and in the bottoms of the main drainageways or on foot slopes below high ridges. The Thedalund and Nelson soils in this complex have profiles similar to the ones described as representative of their respective series, but they are steeper.

Runoff is medium, and the hazard of erosion is moderate. These soils are suited to range, wildlife, recreation, watershed, and pasture. Capability unit IVe-3 dryland; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 2M.

**Thedalund-Rock outcrop complex, hilly (THg).**—This complex is made up of hilly and steep soils in the



sedimentary uplands. It is 40 to 70 percent Thedalund loam, 10 to 30 percent Midway silty clay loam, 10 to 20 percent Rock outcrop and Shale outcrop, and 5 to 15 percent McRae loam. Slopes are mostly 15 to 25 percent, but they range to 35 percent. The Thedalund and Midway soils are intermixed, but the Midway soil is generally around areas of Shale outcrop and has slopes of 25 to 35 percent. The McRae soil is in 1- to 5-acre patches in wide valleys. The Thedalund and Midway soils in this complex have profiles similar to the ones described as representative of their respective series, but they are steeper.

Runoff is rapid, and the hazard of erosion is severe. Runoff waters carry a moderate amount of sediment. These soils are suited to range, recreation, watershed, and game range. The timbered areas are mainly in deep, narrow valleys and on north-facing hillsides. The principal tree species are ponderosa pine and Rocky Mountain juniper. The average site index for the ponderosa pine is about 65.

The stands are generally open, and only isolated areas are overstocked. Timber harvest is limited to scattered overstocked areas. Most areas are accessible for logging and control of fire. Capability unit VIe-1 dryland; Thin Hilly range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

**Thedalund-Rock outcrop complex, very steep (THh).**—This complex is made up of steep and very steep soils in the sedimentary uplands. It is about 35 percent Thedalund loam, 30 percent Rock outcrop and Shale outcrop, and 35 percent Midway silty loam. Slopes are 35 to 90 percent. The Thedalund and Midway soils are intermixed. Rock outcrop is on the rims and very steep sides of hills, valleys, and escarpments where slopes are 65 to 90 percent. The Thedalund and Midway soils in this complex have profiles similar to the ones described as representative of their respective series, but they are steeper.

Runoff is rapid, and the hazard of erosion is severe. Runoff waters carry a high amount of sediment. These soils are suited to range, recreation, watershed, and game range. Capability unit VIIe-1 dryland; Thin Breaks range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

**Thedalund-Travessilla loams, rolling (THk).**—This complex is made up of undulating and rolling soils in the sedimentary uplands. It is about 40 percent Thedalund loam, 25 percent Travessilla loam, 20 percent Cushman loam, and 15 percent Hydro loam. Slopes are mostly 8 to 15 percent, but they range to 2 percent. The Thedalund and Travessilla soils are on narrow ridges, on the crests of surface undulations, and along the valley rim. Some areas of Rock outcrop mark the Travessilla soil. The Cushman soil is on side slopes of ridges and hills and in drainageways. The Hydro soil is in swales and troughs of surface undulations where runoff water collects. Included in mapping are ½- to 2-acre patches of Midway silty clay loam and Nelson sandy loam.

Runoff is medium, and the hazard of erosion is moderate. These soils are suited to range, wildlife, recreation, and watershed. Capability unit VIIs-1 dryland; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 3M.

**Thedalund-Wibaux loams, undulating (THl).**—This complex is made up of undulating soils in the sedimentary uplands. It is about 45 percent Thedalund loam, 40 percent Wibaux loam, and 15 percent Travessilla loam, Spearman loam, and Hydro loam. Slopes are 4 to 8 percent. The Thedalund and Wibaux soils occur in a random pattern in all mapped areas. This complex is in patches less than 40 acres in size. The Wibaux soil is red. The Hydro soil is in troughs between low ridges.

Runoff is medium, and the hazard of erosion is moderate. These soils are suited to range, wildlife, recreation, and watershed. Capability unit VIIs-1 dryland; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 3M.

**Thedalund-Wibaux complex, rolling (THm).**—This complex is made up of rolling soils in the sedimentary uplands. It is 55 to 70 percent Thedalund loam, 20 to 35 percent Wibaux channery loam, and 5 to 15 percent McRae loam. Slopes are 8 to 15 percent. The Thedalund and Wibaux soils occur in a random pattern, but the Wibaux soil has outcrops of red shale and surface fragments of channer size. The McRae soil is in the main drainageways.

Runoff is medium, and the hazard of erosion is moderate. These soils are suited to range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 3M.

**Thedalund-Wibaux stony loams, hilly (THn).**—This complex is made up of hilly and steep soils in the sedimentary uplands. It is 45 to 60 percent Thedalund stony loam, 25 to 35 percent Wibaux stony loam, and 10 to 20 percent Shale outcrop. Minor soils in some valleys make up 5 to 10 percent of the complex. The Thedalund and Wibaux soils occur in a random pattern, but the Wibaux soil is distinguished by its red color. The Thedalund and Wibaux soils in this complex have profiles similar to the ones described as representative of their respective series, but they are steeper, and they are stony.

Runoff is rapid, and the hazard of erosion is severe. These soils are suited to range, recreation, watershed, and game range. Capability unit VIe-1 dryland; Thin Hilly range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

**Thedalund-Wibaux complex, very steep (THo).**—This complex is made up of steep and very steep soils in the sedimentary uplands. It is 40 to 50 percent Thedalund stony loam, 30 to 35 percent Wibaux very stony loam, and 20 to 30 percent Rock outcrop. Slopes are 35 to 90 percent. The soils occur in a random pattern, but the Wibaux soil is distinguished by its red color and its very stony surface. The Thedalund and Wibaux soils in this complex have profiles similar to the ones described as representative of their respective series, but they are steeper; the Thedalund soil has fragments of channer and stone size covering 10 to 20 percent of the surface; and the Wibaux soil has a very stony surface layer.

Runoff is rapid, and the hazard of erosion is severe. These soils are suited to range, recreation, watershed, and game range. Capability unit VIIe-1 dryland; Thin



Breaks range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

## Thurlow Series

The Thurlow series consists of deep, nearly level to gently sloping and rolling, well-drained soils on fans, terraces, and foot slopes. Slopes range from 0 to 15 percent. These soils formed in calcareous alluvium derived from mixed shale and sandstone rock. Elevation ranges from 2,800 to 3,600 feet.

The native vegetation is mainly western wheatgrass, blue grama, green needlegrass, and big sagebrush. Annual precipitation is 12 to 14 inches, the average annual soil temperature is 48° to 50° F, and the frost-free period is 110 to 125 days.

In a representative profile the surface layer is dark grayish-brown silt loam about 2 inches thick. The subsoil is grayish-brown, light olive-brown, and pale-olive heavy silty clay loam and silty clay about 18 inches thick. The substratum is light olive-gray silty clay loam and silt loam that extends to a depth of 61 inches or more.

Permeability is moderately slow, and available water capacity is high. The effective rooting depth is 60 inches or more. These soils are used for irrigated and dryfarmed crops, watershed, wildlife, recreation, and range.

Representative profile of Thurlow silty clay loam, 4 to 8 percent slopes, in grassland, 1,000 feet west and 100 feet north of the center of sec. 34, T. 1 N., R. 35 E.

- A1—0 to 2 inches, dark grayish-brown (2.5Y 4/2) silt loam, very dark grayish brown (2.5Y 3/2) moist; weak, very thin, platy structure; soft, very friable, slightly sticky and slightly plastic; many micro and fine roots; clear, smooth boundary.
- B1—2 to 4 inches, grayish-brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak, medium, prismatic structure; hard, firm, sticky and plastic; common micro and very fine roots; common fine pores; clear, smooth boundary.
- B21t—4 to 9 inches, light olive-brown (2.5Y 5/4) silty clay, dark grayish brown (2.5Y 4/2) moist; strong, medium, prismatic structure parting to moderate, medium, blocky; very hard, firm, very sticky and very plastic; common fine and micro roots; common fine and micro pores; moderately thick, patchy clay films on peds; clear, smooth boundary.
- B22t—9 to 13 inches, light olive-brown (2.5Y 5/4) heavy silty clay loam olive brown (2.5Y 4/4) moist; strong, medium, prismatic structure parting to moderate, medium, blocky; very hard, firm, very sticky and very plastic; common very fine roots; many micro and fine pores; thin, patchy clay films on peds; clear, wavy boundary.
- B3—13 to 20 inches, pale-olive (5Y 6/3) heavy silty clay loam, olive (5Y 5/3) moist; moderate, coarse, prismatic structure parting to moderate, coarse and medium, blocky; very hard, firm, very sticky and very plastic; common very fine roots; many very fine and micro pores; slightly effervescent; gradual, wavy boundary.
- C1ca—20 to 26 inches, light olive-gray (5Y 6/2) silty clay loam, olive (5Y 5/3) moist; moderate, coarse, blocky structure; very hard, firm, sticky and plastic; few very fine roots; many very fine and micro pores; strongly effervescent; common distinct, soft lime masses; gradual, wavy boundary.
- C2—26 to 38 inches, light olive-gray (5Y 6/2) silty clay loam, olive (5Y 5/3) moist; weak, medium, blocky structure; very hard, friable, sticky and plastic;

few very fine roots; common fine pores; strongly effervescent; few fine lime threads and soft lime masses; gradual, wavy boundary.

C3—38 to 49 inches, light olive-gray (5Y 6/2) light silty clay loam, olive (5Y 5/3) moist; massive; hard, friable, sticky and plastic; strongly effervescent; few medium and fine, soft lime masses; diffuse, wavy boundary.

C4—49 to 61 inches, light olive-gray (5Y 6/2) heavy silt loam, olive (5Y 5/3) moist; massive; hard, slightly sticky and plastic; strongly effervescent.

The noncalcareous part of the solum ranges from 10 to 16 inches in thickness. Hue is 10YR or 2.5Y throughout. The A1 horizon is silt loam or loam. The Ap horizon ranges from dark grayish-brown and grayish-brown to light brownish-gray silty clay loam or clay loam. The B2t horizon ranges from 35 to 45 percent clay and is grayish brown, light yellowish brown, and brown. The Cca horizon is light gray, pale yellow, light olive gray, and pale olive.

### Thurlow silty clay loam, 0 to 1 percent slopes (Tk).—

This nearly level soil is on terraces and fans. Areas range from 5 to 40 acres in size. The soil has a profile similar to the one described as representative of the series, but it is less sloping. Included in mapping are 1- to 2-acre areas of Hydro loam and Allentine clay.

Runoff is slow, and the hazard of erosion is slight. This soil is suited to irrigated and dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIIc-1 dryland, IIc-2 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

### Thurlow silty clay loam, 1 to 4 percent slopes (Tm).—

This soil is on nearly level fans and terraces. Slopes are mostly 1 to 2 percent on the terraces and 3 to 4 percent on the fans. The soil has a profile similar to the one described as representative of the series, but it is less sloping.

Runoff is slow, and the hazard of erosion is slight. This soil is suited to irrigated and dryfarmed crops, hay, watershed, wildlife, recreation, and range. Capability unit IIIe-3 dryland, IIe-1 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

### Thurlow silty clay loam, 4 to 8 percent slopes (Tn).—

This soil is on foot slopes and fans. Slopes range from 200 to 600 feet long. The soil has the profile described as representative of the series.

Included with this soil in mapping are areas of Heldt silty clay loam and Midway silty clay loam. These included soils make up 15 to 20 percent of the total area of this mapping unit.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to irrigated and dryfarmed crops, watershed, wildlife, recreation, hay, and range. Capability unit IIIe-3 dryland, IIIe-1 irrigated; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Thurlow-Midway silty clay loams, 4 to 15 percent slopes (To).—**This complex is made up of gently sloping and strongly sloping soils on fans, foot slopes, low knolls, and short ridges. Areas typically include an entire valley below the steeply rising hills and ridges on its border. The complex is 50 percent Thurlow silty clay loam, 40 percent Midway silty clay loam, and 10 percent Lohmiller silty clay loam. The Thurlow soil is in small areas on foot slopes and fans that are dissected by narrow drainageways. The Midway soil is



on knolls and short ridges and is scattered throughout areas of the Thurlow soil. The Midway soil has slopes of 12 to 15 percent. The Lohmiller soil is below areas of Shale outcrop in a narrow band along dry stream channels. Included in mapping are areas of Thedalund loam and outcrops of sandstone near the Midway soils.

Runoff is medium, and the hazard of erosion is moderate. The Thurlow soil receives runoff from soils on valley sides. These soils are suited to range, wildlife, recreation, watershed, and pasture. Capability unit IVE-3 dryland; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

### Toluca Series

The Toluca series consists of deep, undulating, well-drained soils on high terraces and fans in the sedimentary uplands. Slopes are mostly 4 to 8 percent, but they range to 2 percent. These soils formed in calcareous loam alluvium from eroding terraces and weathering shale and sandstone. Elevation ranges from 2,800 to 3,600 feet.

The native vegetation is mainly green needlegrass, fringed sagewort, needleandthread, and big sagebrush. Annual precipitation is 12 to 14 inches, the average annual soil temperature is 48° to 50° F, and the frost-free period is 115 to 125 days.

In a representative profile the surface layer is grayish-brown and dark grayish-brown loam about 3 inches thick. The subsoil is brown and light olive-brown clay loam about 8 inches thick. The substratum is pale-yellow loam and fine sandy loam. Unconformable very gravelly sand is at a depth of about 41 inches.

Permeability and available water capacity are moderate. The effective rooting depth is 60 inches or more. These soils are used for dryfarmed crops, wildlife, recreation, watershed, and range. They are suitable for irrigation.

Representative profile of Toluca loam, in an area of Toluca-Harvey complex, undulating, in grassland, 75 feet east of trail, 1,880 feet east and 525 feet north of the SW. corner sec. 1, T. 1 N., R. 31 E.

- A—0 to 1 inch, grayish-brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak, medium, platy structure; soft, friable, nonsticky and slightly plastic; abrupt, smooth boundary.
- AB—1 inch to 3 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak, medium, prismatic structure parting to weak, medium, platy; slightly hard, friable, slightly sticky and slightly plastic; clear boundary.
- B2t—3 to 8 inches, brown (10YR 5/3 crushed, 4/2 coated) clay loam, dark brown (10YR 4/3 crushed, 3/3 coated) moist; moderate, medium, prismatic structure parting to moderate, medium, blocky; hard, friable, very sticky and plastic; clear boundary.
- B3—8 to 11 inches, light olive-brown (2.5Y 5/4) clay loam, olive brown (2.5Y 4/4) moist; hard, friable, sticky and plastic; clear, wavy boundary.
- C1ca—11 to 17 inches, pale-yellow (2.5Y 7/4) loam, light olive brown (2.5Y 5/4) moist; weak, medium, prismatic structure; hard, friable, sticky and plastic; strongly effervescent; flour lime throughout; gradual, wavy boundary.
- C2—17 to 41 inches, pale-yellow (2.5Y 7/4) fine sandy loam, light olive brown (2.5Y 5/4) moist; massive; slightly hard, friable, nonsticky and slightly plastic; strongly effervescent; clear, wavy boundary.

IIC—41 to 60 inches, very gravelly sand and small pockets of sandy loam.

Depth to calcareous material ranges from 7 to 9 inches. The upper part of the soil ranges from 0 to 15 percent coarse fragments but normally is less than 5 percent. The Ap horizon is grayish brown and light brownish gray in hue of 10YR or 2.5Y. The B2t horizon is brown, grayish brown, and light olive brown. It ranges from 30 to 35 percent clay. The Cca horizon is very pale brown, light gray, and pale yellow. The unconformable IIC horizon is more than 50 percent fragments of pebble size.

**Toluca-Harvey complex, undulating (Tp).**—This complex is made up of undulating soils on dissected high terraces. It is about 60 percent Toluca loam and 40 percent Harvey gravelly loam. Slopes are mostly 4 to 8 percent, but they range to 2 percent. Shallow drainageways make local relief of 5 to 20 feet. The Toluca soil is between drainageways on small, smooth areas where slopes are 2 to 4 percent. The Harvey soil is along drainageways and on narrow ridges and has fragments of pebble size on the surface. The Harvey soil in this complex has a profile similar to the one described as representative of the Harvey series, but the surface layer is gravelly loam.

Runoff is medium, and the hazard of erosion is moderate. These soils are suited to dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIIe-3 dryland; Clayey range site, 10- to 14-inch precipitation zone; windbreak suitability group 2L.

### Travessilla Series

The Travessilla series consists of shallow, undulating and rolling, well-drained soils on hills and ridges in the sandstone uplands. Slopes are mostly 4 to 15 percent, but they range to 2 percent. The soils formed in material weathered in place from calcareous, hard sandstone. Elevation ranges from 3,200 to 3,800 feet.

The native vegetation is mainly prairie sandreed, Indian ricegrass, skunkbush sumac, and blue grama. Annual precipitation is 12 to 14 inches, the average annual soil temperature is 50° to 55° F, and the frost-free period is 115 to 120 days.

In a representative profile the surface layer is grayish-brown sandy loam about 2 inches thick. The underlying material is pale-brown sandy loam and channery sandy loam. Hard sandstone is at a depth of about 18 inches.

Permeability is rapid, and available water capacity is very low. The effective rooting depth is about 18 inches. These soils are used for range, recreation, wildlife, and watershed.

Representative profile of Travessilla sandy loam, in an area of Travessilla-Thedalund loams, rolling, in grassland, 300 feet north and 300 feet east of the SW. corner sec. 33, T. 4 S., R. 29 E.

- A—0 to 2 inches, grayish-brown (10YR 5/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak, fine, granular structure; soft, very friable, nonsticky and nonplastic; clear, smooth boundary.
- C1—2 to 13 inches, pale-brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; weak, thick, platy structure; soft, very friable, nonsticky and slightly plastic; strongly effervescent; gradual, wavy boundary.
- C2—13 to 18 inches, pale-brown (10YR 6/3) channery sandy loam, brown (10YR 5/3) moist; massive; soft, very



friable, nonsticky and nonplastic; 35 percent partly weathered, horizontally oriented, ¼-inch sandstone fragments of channer size; strongly calcareous; abrupt, wavy boundary.

R—18 to 20 inches, hard, calcareous sandstone.

Depth to bedrock ranges from 6 to 20 inches. The soil ranges from 10 to 35 percent coarse fragments of stone, channer, and gravel size. Typically, there is no accumulated calcium carbonate in the soil, but the upper part of the bedrock in places has thin lime casts on the bottoms of the coarse fragments. The soil is brown, light brown, pale brown, and light yellowish brown in hue of 2.5Y to 7.5Y throughout. The A horizon is loam, channery loam, or sandy loam.

#### **Travessilla-Rock outcrop complex, rolling (TR).—**

This complex is made up of undulating and rolling soils on hills and ridges in the sedimentary uplands. It is about 70 percent Travessilla channery loam and 30 percent Rock outcrop. Slopes are mostly 8 to 15 percent, but they range to 4 percent. The soils are intermixed, but 25 to 50 percent of the surface of the Travessilla soil is covered with 3- to 8-inch, hard sandy shale fragments of channer size. Rock outcrop is level with the land surface. The Travessilla soil in this complex has a profile similar to the one described as representative of the Travessilla series, but the surface layer is loam 3 to 5 inches thick. Included in mapping are areas of Lavina loam in the concave heads of drainageways and in troughs between low ridges.

Runoff is medium, and the hazard of erosion is moderate. These soils are suited to range, wildlife, recreation, and watershed. Capability unit VIs-1 dryland; Shallow range site, 10- to 14-inch precipitation zone; windbreak suitability group 4.

**Travessilla-Thedalund loams, rolling (TS).—**This complex is made up of rolling soils on hills and ridges in the sedimentary uplands. It is about 40 percent Travessilla loam and sandy loam, 40 percent Thedalund loam, and 15 percent Rock outcrop. Slopes are 8 to 15 percent. The soils are intermixed, but the Thedalund soil is typically on low ridges and hills and has slopes of 8 to 15 percent. The Travessilla soil is between ridges where erosion has exposed the sandstone and sandy shale. It has slopes of 2 to 10 percent. Rock outcrop is level with the soil surface and also occurs as ledges. The Thedalund soil in this complex has a profile similar to the one described as representative of the Thedalund series, but it is steeper. The Travessilla sandy loam has the profile described as representative of the Travessilla series.

Runoff is medium, and the hazard of erosion is moderate. These soils are suited to range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 3M.

#### **Trulon Series**

The Trulon series consists of moderately deep, rolling, well-drained soils on hills and ridges in the sedimentary uplands. Slopes are mostly 8 to 15 percent, but they range to 4 percent. These soils formed in place in material weathered from calcareous loam shale and limestone. Elevation ranges from 3,900 to 4,700 feet.

The native vegetation is mainly bluebunch wheatgrass, prairie junegrass, western wheatgrass, and Idaho fescue. Annual precipitation is 14 to 16 inches, the average annual soil temperature is 45° to 46° F, and the frost-free period is 95 to 105 days.

In a representative profile the surface layer is grayish-brown and brown loam about 7 inches thick. The underlying material is pale-brown, very pale brown, and pink loam and channery. Limestone is at a depth of about 30 inches.

Permeability is moderately slow, and available water capacity is low. The effective rooting depth is about 30 inches. The soils are used for range, wildlife, recreation, and watershed.

Representative profile of Trulon loam, in an area of Lap-Trulon complex, rolling, in a cultivated area, 1,300 feet south and 200 feet east of the NW. corner sec. 18, T. 6 S., R. 31 E.

Ap—0 to 3 inches, grayish-brown (10YR 5/2) loam, dark brown (10YR 3/3) moist; weak, medium, platy structure; slightly hard, friable, sticky and slightly plastic; very slightly effervescent; clear, smooth boundary.

A12—3 to 7 inches, brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak, medium, prismatic structure; hard, friable, slightly sticky and slightly plastic; slightly effervescent; wavy boundary.

C1—7 to 9 inches, pale-brown (10YR 6/3) loam, brown (10YR 5/3) moist; moderate, coarse, prismatic structure; hard, friable, slightly sticky and slightly plastic; about 10 percent limestone fragments; violently effervescent; common soft segregated lime masses; gradual boundary.

C2ca—9 to 15 inches, very pale brown (10YR 7/3) loam, pale brown (10YR 6/3) moist; weak, coarse, prismatic structure; hard, friable, slightly sticky and slightly plastic; few limestone fragments; violently effervescent; lime flour and common medium lime masses; clear, wavy boundary.

C3—15 to 30 inches, pink (7.5YR 8/3) channery loam, pink (7.5YR 7/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; 20 percent limestone fragments of channer size; violently effervescent; thick lime coatings on fragments; abrupt, irregular boundary.

R—30 inches, hard limestone.

Depth to bedrock ranges from 20 to 40 inches. The soil ranges from 15 to 35 percent coarse fragments of limestone. Below a depth of 10 inches and above bedrock, the soil is loam, or silty clay loam. The A horizon has hue of 10YR or 2.5Y. The Cca and C3 horizons range from pinkish white to pale yellow in hue of 2.5Y to 7.5YR.

Trulon soils in the Big Horn County Area are mapped only with Lap soils.

#### **Tullock Series**

The Tullock series consists of moderately deep, rolling, well-drained soils on hills and ridges in the sedimentary uplands. Slopes are mostly 8 to 15 percent, but they range to 4 percent. These soils formed in material weathered in place from calcareous, weakly cemented sandstone. Elevation ranges from 3,200 to 3,600 feet.

The native vegetation is mainly sand bluestem, little bluestem, prairie sandreed, needleandthread, and annual eriogonum. Annual precipitation is 13 to 14 inches, the average annual soil temperature is 49° to 50° F, and the frost-free period is 110 to 120 days.



In a representative profile the surface layer is grayish-brown loamy fine sand about 2 inches thick. The underlying material is grayish-brown, light yellowish-brown, and light-gray loamy fine sand and loamy sand. Weakly cemented sandstone is at a depth of about 38 inches.

Permeability is rapid, and available water capacity is very low or low. The effective rooting depth is about 40 inches. These soils are used for range, wildlife, recreation, and watershed.

Representative profile of Tullock loamy fine sand, rolling, in grassland, 600 feet north and 100 feet east of the SW. corner sec. 36, T. 1 N., R. 34 E.

- A—0 to 2 inches, grayish-brown (2.5Y 5/2) heavy loamy fine sand, dark grayish brown (2.5Y 4/2) moist; single grained; loose (dry and moist), nonsticky and nonplastic; common fine roots; clear, smooth boundary.
- C1—2 to 7 inches, grayish-brown (2.5Y 5/2) loamy fine sand, dark grayish brown (2.5Y 4/2) moist; weak, coarse, prismatic structure; slightly hard, very friable, nonsticky and nonplastic; common fine roots; gradual, wavy boundary.
- C2—7 to 17 inches, light yellowish-brown (2.5Y 6/4) loamy sand, light olive brown (2.5Y 5/4) moist; weak, coarse, prismatic structure; soft, very friable, nonsticky and nonplastic; common very fine and micro roots; very slightly effervescent; gradual, wavy boundary.
- C3—17 to 33 inches, light yellowish-brown (2.5Y 6/4) loamy sand, light olive brown (2.5Y 5/4) moist; massive; hard, very friable, nonsticky and slightly plastic; few fine roots; slightly effervescent; diffuse boundary.
- C4—33 to 38 inches, light-gray (2.5Y 7/2) loamy sand, grayish brown (2.5Y 5/2) moist; massive; hard, friable, slightly sticky and slightly plastic; few fine roots; strongly effervescent; diffuse, wavy boundary.
- C5—38 to 46 inches, pale-yellow (2.5Y 7/4) sandstone.

Depth to weakly consolidated sandstone bedrock ranges from 20 to 40 inches. The A horizon is grayish brown and light yellowish brown. The C horizon is grayish brown, light yellowish brown, light gray, and pale yellow.

**Tullock loamy fine sand, rolling (Tu).**—This soil is on valley rims, hills, and ridges in the sedimentary uplands. Slopes are mostly 8 to 15 percent, but they range to 4 percent. Areas range from 30 to 125 acres in size and are scattered throughout sandstone highlands. There is evidence of soil blowing on the east and southeast sides of Rock outcrop, and there are a few blowouts as much as ½ acre in size. Local relief ranges from 20 to 75 feet. Slopes are short and as much as 150 feet long.

Included with this soil in mapping are areas of Rock outcrop, Travessilla loamy fine sand, and Glenberg fine sandy loam. The Glenberg soil is below sandstone ledges. The Travessilla soil is above rock ledges and adjacent to the ground-level Rock outcrop. These included soils make up about 25 percent of the total area of this mapping unit. Also included are areas of soils that have sandstone at a depth of more than 40 inches.

Runoff is slow, and the hazard of erosion is severe. This soil is suited to range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Sands range site, 10- to 14-inch precipitation zone; windbreak suitability group 3M.

## Twin Creek Series

The Twin Creek series consists of deep, gently sloping to strongly sloping, well-drained soils on fans, terraces, and foot slopes. Slopes range from 2 to 15 percent. These soils formed in red loam and silt loam alluvium washed from fine-grained sandstone and shale. Elevation ranges from 3,700 to 4,800 feet.

The native vegetation is mainly Sandberg bluegrass, snowberry, prairie junegrass, and Idaho fescue. Annual precipitation is 15 to 17 inches, the average annual soil temperature is 45° to 46° F, and the frost-free period is 95 to 110 days.

In a representative profile the surface layer is reddish-brown loam about 3 inches thick. The subsoil is reddish-brown loam about 15 inches thick. The substratum is red and light-red loam that extends to a depth of 65 inches or more.

Permeability is moderate, and available water capacity is high. The effective rooting depth is 60 inches or more. These soils are used for range, wildlife, recreation, watershed, and irrigated and dryfarmed crops.

Representative profile of Twin Creek loam, 4 to 8 percent slopes, in grassland, 1,000 feet south and 50 feet west of the NE. corner sec. 23, T. 5 S., R. 27 E.

- A1—0 to 3 inches, reddish-brown (5YR 4/4) loam, dark reddish brown (5YR 3/3) moist; moderate, medium, platy structure; slightly hard, friable, nonsticky and slightly plastic; common very fine roots; clear, smooth boundary.
- B21—3 to 11 inches, reddish-brown (5YR 4/4) heavy loam, dark reddish brown (5YR 3/3) moist; weak, medium, prismatic structure parting to moderate, medium, blocky; hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine pores; gradual, wavy boundary.
- B22—11 to 18 inches, reddish-brown (5YR 5/4) heavy loam, reddish brown (5YR 4/4) moist; moderate, medium, prismatic structure parting to moderate, medium, blocky; hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine pores; gradual, wavy boundary.
- C1—18 to 26 inches, red (2.5YR 5/6) loam, reddish brown (2.5YR 4/4) moist; moderate, coarse, blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine pores; slightly effervescent; few very fine lime threads; clear, wavy boundary.
- C2ca—26 to 39 inches, red (2.5Y 5/6) loam, red (2.5Y 4/6) moist; weak, fine, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine pores strongly effervescent; common fine lime threads; diffuse, wavy boundary.
- C3—39 to 65 inches, light-red (2.5YR 6/6) loam, red (2.5YR 4/6) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; 15 percent (volume) fine shale chips; slightly effervescent.

Depth to calcareous material ranges from 12 to 20 inches. The soil between depths of 10 and 40 inches is loam, but in places it is stratified with silt loam or clay loam. Below a depth of 30 inches the soil ranges from 0 to 15 percent coarse fragments. The A1 and B2 horizons are reddish brown, reddish gray, and weak red in hue of 2.5YR or 5YR. The C horizon is red, light red, and light reddish brown in hue of 2.5YR or 10R.

**Twin Creek loam, 2 to 4 percent slopes (Tv).**—This soil is on fans and terraces in the red shale highlands. Areas range from 15 to 25 acres in size. Slopes range from 200 to 450 feet long. The soil has a profile similar to the one described as representative of the series,



but it is less sloping. Included in mapping are areas of soils that have a surface layer of silt loam or very fine sandy loam.

Runoff is slow, and the hazard of erosion is moderate. This soil is suited to irrigated and dryfarmed crops, hay, watershed, wildlife, recreation, and range. Capability unit IIe-2 dryland, IIe-1 irrigated; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Twin Creek loam, 4 to 8 percent slopes (Tw).**—This soil is in narrow areas on fans and foot slopes in the shale highlands. It has the profile described as representative of the series.

Runoff is medium, and the hazard of erosion is moderate. Most areas receive runoff from soils above them. This soil is suited to dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIIe-2 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Twin Creek loam, 8 to 15 percent slopes (Tx).**—This soil is on foot slopes below shale escarpments in the shale uplands. Many of the areas are dissected by narrow drainageways and gullies spaced 250 to 400 feet apart. Scattered flat sandstone and shale fragments are on the soil surface. The soil has a profile similar to the one described as representative of the series, but it is steeper and has scattered sandstone and shale fragments.

Runoff is rapid, and the hazard of erosion is severe. Most areas receive runoff from the steep soils above them. This soil is suited to watershed, wildlife, recreation, range, hay, pasture, and limited dryfarmed crops. Capability unit IVe-2 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Twin Creek-Korchea complex, 2 to 8 percent slopes (TY).**—This complex is made up of gently sloping soils in the red shale highlands. It is about equal parts of Twin Creek silt loam and Korchea loam. The Twin Creek soil is on the fans and foot slopes where slopes are 5 to 8 percent. The Korchea soil is on the valley bottoms where slopes are 2 to 4 percent.

Included with this soil in mapping are valley bottoms that are 100 to 200 feet wide and fans and foot slopes that border the valleys and are dissected by deep drainageways at intervals of 400 to 600 feet.

Runoff is medium, and the hazard of erosion is moderate. Most areas receive runoff from the steep soils above them. The valley bottom is subject to flooding. These soils are suited to wildlife, recreation, watershed, range, hay, and limited dryfarmed crops. Capability unit IIe-2 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

## Vananda Series

The Vananda series consists of deep, nearly level to gently sloping and undulating, well-drained, sodium-affected soils on terraces, fans, and foot slopes. Slopes range from 0 to 8 percent. These soils formed in alkaline clay alluvium derived from fresh- and salt-water shale. Elevation ranges from 2,700 to 3,800 feet.

The native vegetation is mainly greasewood, Sand-

berg bluegrass, wild onion, and western wheatgrass. Annual precipitation is 13 to 14 inches, the average annual soil temperature is 48° to 50° F, and the frost-free period is 115 to 125 days.

In a representative profile the surface layer is light brownish-gray silty clay about 1 inch thick. The underlying material is grayish-brown and olive-gray clay that extends to a depth of 60 inches or more.

Permeability is very slow, and available water capacity is high. The effective rooting depth is 60 inches or more. These soils are used for range, wildlife, recreation, watershed, and irrigated crops.

Representative profile of Vananda clay, 1 to 8 percent slopes, in grassland, 250 feet north and 300 feet west of the SE. corner sec. 12, T. 2 S., R. 30 E.

- A—0 to 1 inch, light brownish-gray (2.5Y 6/2) silty clay, olive gray (5Y 4/2) moist; strong, fine, granular structure; hard, firm, sticky and plastic; slightly effervescent; abrupt boundary.
- C1—1 inch to 3 inches, grayish-brown (2.5Y 5/2) clay, olive (5Y 4/3) moist; moderate, coarse, blocky structure; very hard, firm, very sticky and very plastic; strongly effervescent; clear boundary.
- C2—3 to 12 inches, grayish-brown (2.5Y 5/2) clay, olive gray (5Y 4/2) moist; moderate, medium and coarse, blocky structure; extremely hard, very firm, very sticky and very plastic; strongly effervescent; clear, wavy boundary.
- C3cs—12 to 16 inches, olive-gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; massive; extremely hard, very firm, very sticky and very plastic; strongly effervescent; common crystals of gypsum and other salts; gradual, wavy boundary.
- C4cs—16 to 29 inches, olive-gray (5Y 5/2) clay, dark olive gray (5Y 3/2) moist; massive; extremely hard, very firm, very sticky and very plastic; strongly effervescent; common crystals of gypsum and other salts; gradual, wavy boundary.
- C5—29 to 60 inches, olive-gray (5Y 5/2) clay, dark olive gray (5Y 3/2) moist; massive; extremely hard, very firm, very sticky and very plastic; strongly effervescent; few gypsum and salt crystals.

The soil between depths of 10 and 40 inches ranges from 45 to 60 percent clay. Hue is 2.5Y or 5Y throughout. The C horizon is grayish brown, light olive gray, olive gray, light gray, and pale olive.

**Vananda clay, 0 to 1 percent slopes (Va).**—This nearly level soil is on terraces. It has a profile similar to the one described as representative of the series, but it is less sloping. Included in mapping are spots of Kyle clay and Bone clay.

Runoff is slow, and the hazard of erosion is slight. In irrigated areas the water table is within 5 feet of the surface late in summer. This soil is suited to watershed, wildlife, recreation, range, pasture, and limited irrigated crops. Only salt-tolerant plants are suitable unless the salts have been leached out of the soil. Capability unit VIs-1 dryland, IVs-1 irrigated; Dense Clay range site, 10- to 14-inch precipitation zone; windbreak suitability group 3S.

**Vananda clay, 1 to 8 percent slopes (Vc).**—This soil is in 20- to 100-acre areas on terraces, fans, and foot slopes in the shale highlands. The foot slopes and terraces have narrow rills and gullies spaced 100 to 200 feet apart. The soil has the profile described as representative of the series. Included in mapping are small areas of Allentine and Kyle soils.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to range, wildlife, recrea-

tion, and watershed. Capability unit VIe-1 dryland; Dense Clay range site, 10- to 14-inch precipitation zone; windbreak suitability group 3S.

### Vebar Series

The Vebar series consists of moderately deep, undulating to hilly and steep, well-drained soils on hills and ridges in the sedimentary uplands. Slopes range from 4 to 35 percent. These soils formed in place in material weathered from calcareous sandstone. Elevation ranges from 3,400 to 4,400 feet.

The native vegetation is mainly milkvetch, prairie sandreed, needleandthread, and big sagebrush. Annual precipitation is 14 to 16 inches, the average annual soil temperature is 46° to 47° F, and the frost-free period is 100 to 115 days.

In a representative profile the surface layer is grayish-brown sandy loam about 2 inches thick. The subsoil is grayish-brown, dark-brown, light olive-brown, and light yellowish-brown sandy loam and sandy clay loam about 25 inches thick. The substratum is pale-yellow sandy loam. Weakly consolidated sandstone is at a depth of about 40 inches.

Permeability is moderately rapid, and available water capacity is low. The effective rooting depth is about 40 inches. These soils are used for range, wildlife, recreation, watershed, and dryfarmed crops.

Representative profile of Vebar sandy loam, in an area of Vebar-Castner complex, undulating, in grassland, 200 feet north and 500 feet east of the SW. corner sec. 24, T. 6 S., R. 30 E.

- A1—0 to 2 inches, grayish-brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak, medium, granular structure; soft, very friable, nonsticky and slightly plastic; clear boundary.
- B1—2 to 4 inches, grayish-brown (10YR 5/2) sandy loam, dark grayish brown (10YR 3/2) moist; weak, medium, prismatic structure parting to weak, thick, platy; slightly hard, friable, slightly sticky and slightly plastic; clear boundary.
- B21—4 to 10 inches, dark-brown (10YR 4/3) sandy loam, dark brown (10YR 3/3 rubbed, 3/2 coats) moist; moderate, medium, prismatic structure; hard, friable, sticky and plastic; few clay bridges between sand grains; clear, wavy boundary.
- B22—10 to 15 inches, light olive-brown (2.5Y 5/4) sandy clay loam, olive brown (2.5Y 4/4) moist; moderate, coarse, prismatic structure; hard, friable, slightly sticky and plastic; few clay bridges between sand grains; gradual, wavy boundary.
- B3—15 to 27 inches, light yellowish-brown (2.5Y 6/4) sandy loam, light olive brown (2.5Y 5/4) moist; weak, coarse, prismatic structure; hard, friable, slightly sticky and slightly plastic; gradual, wavy boundary.
- C1ca—27 to 40 inches, pale-yellow (2.5Y 7/4) sandy loam, light yellowish brown (2.5Y 6/4) moist; massive; hard, friable, nonsticky and nonplastic; appears to be weathered sandstone penetrated by a few plant roots; strongly effervescent; diffuse, smooth boundary.
- C2—40 to 55 inches, weakly consolidated sandstone, strongly effervescent.

Depth to calcareous material ranges from 18 to 30 inches, and depth to sandstone, from 20 to 40 inches. The soil between depths of 10 and 40 inches ranges from 10 to 18 percent clay. Hue ranges from 10YR to 2.5Y throughout. The A horizon is dark grayish brown, grayish brown, and brown. The B2 horizon is brown, grayish brown, dark brown, light olive brown, and light brownish gray. The C horizon is light yellowish brown and pale yellow.

**Vebar fine sandy loam, undulating (Vd).**—This undulating soil is on low ridges and hills in the sandstone highlands. Areas are less than 40 acres in size. Slopes are 4 to 8 percent. Local relief is 15 to 30 feet. The soil has a profile similar to the one described as representative of the series, but the surface layer is fine sandy loam. Included in mapping are small areas of Parshall fine sandy loam.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to dryfarmed crops, hay, wildlife, recreation, watershed, and range. Capability unit IIIe-2 dryland; Sandy range site, 15- to 19-inch precipitation zone; windbreak suitability group 2M.

**Vebar fine sandy loam, rolling (Ve).**—This rolling soil is on ridges and hills in the sandstone highlands. Slopes are 8 to 15 percent. Local relief ranges from 25 to 60 feet. The soil has a profile similar to the one described as representative of the series, but it is steeper, and the surface layer is fine sandy loam.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to range, wildlife, recreation, watershed, hay, pasture, and dryfarmed crops. Capability unit IVe-2 dryland; Sandy range site, 15 to 19-inch precipitation zone; windbreak suitability group 2M.

**Vebar-Castner complex, undulating (VF).**—This complex is made up of undulating soils on hills and ridges in the sedimentary uplands. It is 50 percent Vebar sandy loam, 40 percent Castner sandy loam, and 10 percent Rock outcrop and Reeder loam. Slopes are 4 to 8 percent. The soils are intermixed, but the Castner soil typically is in the vicinity of Rock outcrop. The Vebar soil in this complex has the profile described as representative of the Vebar series. The Castner soil has a profile similar to the one described as representative of the Castner series, but it is less sloping. Included in mapping are areas of soils that have a light reddish-brown substratum.

Runoff is medium, and the hazard of erosion is moderate. These soils are suited to range, wildlife, recreation, and watershed. Capability unit VIIs-1 dryland; Sandy range site, 15- to 19-inch precipitation zone; windbreak suitability group 3M.

**Vebar-Castner complex, rolling (VH).**—This complex is made up of rolling soils on hills and ridges in the sedimentary uplands. It is about 50 percent Vebar sandy loam, 40 percent Castner sandy loam, and 10 percent Rock outcrop. Slopes are 8 to 15 percent. The Castner soil is typically in the vicinity of Rock outcrop. The Vebar soil in this complex has a profile similar to the one described as representative of the Vebar series, but it is steeper. Included in mapping are areas of soils that have a substratum of loam.

Runoff is medium, and the hazard of erosion is moderate. These soils are suited to range, wildlife, recreation, and watershed. Capability unit VIIs-1 dryland; Sandy range site, 15- to 19-inch precipitation zone; windbreak suitability group 3M.

**Vebar complex, rolling (VM).**—This complex is made up of rolling and hilly soils on hills and ridges in the sedimentary uplands. It is 60 percent Vebar fine sandy loam, 25 percent Dast sandy loam, 10 percent Farnuf loam and Farnuf sandy loam, and 5 percent Rock outcrop. Slopes are mostly 8 to 15 percent, but they range



to 25 percent. The Vebar and Farnuf soils are on the tops and sides of wide ridges. The Farnuf sandy loam is also on foot slopes. The Dast soil is on narrow ridges, hills, and sides of deep drainageways. It has slopes of 15 to 25 percent. The Vebar and Dast soils in this complex have profiles similar to the ones described as representative of their respective series, but they are steeper, and the Vebar soil has a surface layer of fine sandy loam 6 to 8 inches thick.

Included with these soils in mapping are areas of soils that are similar to this Vebar soil but that do not have sandstone within 40 inches of the surface.

Runoff is medium, and the hazard of erosion is moderate. These soils are suited to range, wildlife, recreation, watershed, and pasture. Capability unit IVe-2 dryland; Sandy range site, 15- to 19-inch precipitation zone; windbreak suitability group 2M.

### Wages Series

The Wages series consists of deep, nearly level to gently sloping, well-drained soils on fans, foot slopes, and terraces. Slopes range from 0 to 8 percent. These soils formed in calcareous alluvium. Elevation ranges from 3,000 to 3,600 feet.

The native vegetation is mainly western wheatgrass, big sagebrush, cudweed sagewort, and green needlegrass. Annual precipitation is 13 to 14 inches, the average annual soil temperature is 47° to 49° F, and the frost-free period is 105 to 115 days.

In a representative profile the surface layer is grayish-brown loam about 6 inches thick. The subsoil is brown and light brownish-gray clay loam and loam about 16 inches thick. The substratum is light brownish-gray clay loam that grades to light-gray fine sandy loam and extends to a depth of 60 inches or more.

Permeability is moderate, and available water capacity is high. The effective rooting depth is 60 inches or more. These soils are used for irrigated and dry-farmed crops, watershed, wildlife, recreation, and range.

Representative profile of Wages loam, 4 to 8 percent slopes, in a cultivated area, 1,320 feet south of the center of sec. 6, T. 1 S., R. 37 E.

Ap—0 to 6 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak, blocky structure parting to weak, medium, granular; hard, friable, nonsticky and slightly plastic; abrupt, smooth boundary.

B21t—6 to 9 inches, brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; moderate, medium and coarse, prismatic structure; hard, friable, sticky and plastic; thin, patchy clay films on peds; gradual, wavy boundary.

B22t—9 to 13 inches, brown (10YR 5/3) light clay loam, dark brown (10YR 3/3) moist; moderate, coarse, prismatic structure; hard, friable, sticky and plastic; thin, patchy clay films on peds; clear, wavy boundary.

B3ca—13 to 22 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak, coarse, blocky structure; hard, friable, slightly sticky and slightly plastic; slightly effervescent; few fine, soft, segregated lime masses; clear, wavy boundary.

C1ca—22 to 31 inches, light brownish-gray (10YR 6/2) light clay loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable, slightly sticky and

plastic; strongly effervescent; common fine, soft, segregated lime masses; clear, wavy boundary.  
C2—31 to 60 inches, light-gary (10YR 7/2) fine sandy loam, brown (10YR 5/3) moist; massive; slightly hard, friable, nonsticky and slightly plastic; strongly effervescent; few fine, soft, segregated lime masses.

Depth to calcareous material ranges from 10 to 13 inches. The dark-colored surface layer ranges from 8 to 12 inches in thickness. Hue is 10YR to 2.5Y throughout. The A horizon is grayish-brown and dark grayish-brown loam, silt loam, or very fine sandy loam. The B2t horizon is heavy loam or clay loam. The Bca and Cca horizons are pale brown, light brownish gray, and light gray.

**Wages loam, 0 to 2 percent slopes (Wa).**—This nearly level soil is on terraces and fans. Areas range from 5 to 20 acres in size. The soil has a profile similar to the one described as representative of the series, but it is less sloping.

Included with this soil in mapping are areas of Lohmiller silty clay loam and areas of soils that have 5 to 15 percent gravel on the surface and throughout the soil.

Runoff is slow, and the hazard of erosion is slight. This soil is suited to irrigated and dryfarmed crops, hay, watershed, wildlife, recreation, and range. Capability unit IIIc-1 dryland, IIc-1 irrigated; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Wages loam, 2 to 4 percent slopes (Wb).**—This soil is on terraces and fans. Areas range from 5 to 30 acres in size. The soil has a profile similar to the one described as representative of the series, but it is less sloping.

Included with this soil in mapping in the burned shale highlands are areas of reddish-brown soils that have procelanite gravel on the surface and throughout the soil.

Runoff is slow, and the hazard of erosion is slight. This soil is suited to irrigated and dryfarmed crops, hay, watershed, wildlife, recreation, and range. Capability unit IIIe-3 dryland, IIe-1 irrigated; Silty range site, 10- to 14-inch precipitation zone; windbreak suitability group 1.

**Wages loam, 4 to 8 percent slopes (Wc).**—This soil is on fans and foot slopes. Areas range from 10 to 20 acres in size. The soil has the profile described as representative of the series. Included in mapping are areas of reddish-brown soils that have procelanite gravel on the surface and throughout the soil.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to irrigated and dryfarmed crops, hay, watershed, wildlife, recreation, and range. Cultivated areas need protection against runoff from soils above them. Capability unit IIIe-3 dryland, IIIe-1 irrigated; Silty range site 10- to 14-inch precipitation zone; windbreak suitability group 1.

### Wayden Series

The Wayden series consists of shallow, strongly sloping to very steep and rolling to hilly, excessively drained soils on hills and ridges in dissected sedimentary uplands. Slopes range from 8 to 55 percent. These soils formed in material weathered in place from clay shale. Elevation ranges from 3,600 to 4,600 feet.



The native vegetation is mainly bluebunch wheatgrass, scurfpea, broom snakeweed, and western wheatgrass. Annual precipitation is 14 to 17 inches, the average annual soil temperature is 45° to 47° F, and the frost-free period is 90 to 105 days.

In a representative profile the surface layer is grayish-brown silty clay loam about 2 inches thick. The subsoil is grayish-brown silty clay loam about 5 inches thick. The substratum is light brownish-gray silty clay loam that is about 35 percent weathered shale chips. Shale is at a depth of about 19 inches.

Permeability is slow, and available water capacity is very low or low. The effective rooting depth is about 20 inches. These soils are used for range, wildlife, recreation, and watershed.

Representative profile of Wayden silty clay loam, rolling, in grassland, 1,400 feet west of the center of sec. 20, T. 5 S., R. 29 E.

- A—0 to 2 inches, grayish-brown (2.5Y 5/2) light silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak, thin, platy structure parting to moderate, fine, granular; hard, friable, slightly sticky and plastic; many fine roots; slightly effervescent; clear, smooth boundary.
- B2—2 to 7 inches, grayish-brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak, coarse, prismatic structure parting to weak, coarse, blocky; very hard, firm, sticky and very plastic; common fine roots; common very fine pores; strongly effervescent; clear, wavy boundary.
- C1—7 to 11 inches, light brownish-gray (2.5Y 6/2) heavy silty clay loam, grayish brown (2.5Y 5/2) moist; weak, coarse, prismatic structure parting to weak, fine, blocky; very hard, firm, sticky and very plastic; common fine roots; common fine pores; 15 percent (volume) weathered fine shale chips; strongly effervescent; few fine, soft lime masses; gradual, wavy boundary.
- C2—11 to 14 inches, light brownish-gray (2.5Y 6/2) heavy silty clay loam, grayish brown (2.5Y 5/2) moist; strong, coarse and very coarse, platy structure; very hard, firm, very sticky and very plastic; few fine roots; few fine pores; 30 percent (volume) weathered, fine shale chips; strongly effervescent; few fine lime threads and medium lime masses; gradual, wavy boundary.
- C3—14 to 19 inches, light brownish-gray (2.5Y 6/2) heavy silty clay loam, grayish brown (2.5Y 5/2) moist; strong, very thick, platy structure; very hard, very firm, very sticky and very plastic; few fine roots; few fine pores; 50 percent (volume) weathered shale chips; strongly effervescent; few coarse, soft lime masses; diffuse, smooth boundary.
- C4—19 to 28 inches, platy shale, root mats between the horizontal layers of shale.

Depth to soft shale ranges from 10 to 20 inches. The soil is silty clay, clay loam, or silty clay loam. Hue is 2.5Y or 5Y throughout. The A horizon is grayish brown and light brownish gray. The C horizon is light brownish gray, light olive gray, and pale olive.

**Wayden silty clay loam, rolling (WD).**—This rolling soil is on deeply dissected clay shale highlands. Slopes are 8 to 15 percent. Slopes range from 100 to 300 feet long. The soil has the profile described as representative of the series. Included in mapping were 2- to 5-acre areas of Regent silty clay loam.

Runoff is medium, and the hazard of erosion is moderate. This soil is suited to range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 3M.

**Wayden silty clay loam, hilly (WE).**—This hilly and steep soil is on deeply dissected clay shale highlands. Slopes are 15 to 35 percent. The points and steep sides of the ridges have scattered areas of Shale outcrop. The soil has a profile similar to the one described as representative of the series, but it is steeper.

Included with this soil in mapping are areas of soils that have a surface layer of clay loam. Shale outcrop makes up 15 to 20 percent of some areas of this mapping unit.

Runoff is rapid, and the hazard of erosion is severe. This soil is suited to range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Thin Hilly range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**Wayden-Arnegard complex, hilly (WF).**—This complex is made up of hilly and very steep soils on deeply dissected sedimentary uplands. It is about 35 percent Wayden silty clay loam, 35 percent Arnegard loam, and 20 percent Doney loam. Slopes are mostly 15 to 35 percent, but they range to 75 percent. The Wayden and Doney soils have slopes of 25 to 45 percent and are on ridges and upper side slopes. The Arnegard soil is on narrow valley fans and foot slopes and includes several seep spots. The Wayden and Arnegard soils in this complex have profiles similar to the ones described as representative of their respective series, but they are steeper. The vegetation consists of serviceberry, plum, snowberry, cinquefoil, mountain maple, ash, thornapple, roses, and thick patches of aspen around the seeps.

Included with these soils in mapping are areas of Castner loam, Regent silty clay loam, and Rock outcrop that make up about 10 percent of the total acreage of this mapping unit. Rock outcrop is on the steep west faces of escarpments.

Runoff is rapid, and the hazard of erosion is severe. These soils are suited to range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Thin Hilly range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**Wayden-Grail complex, hilly (WG).**—This complex is made up of hilly and steep soils on deeply dissected sedimentary uplands. It is about 40 percent Wayden silty clay loam and 30 percent Grail clay loam. Slopes are mostly 15 to 35 percent, but they range to 8 percent. The Wayden soil is on shale ridges where erosion has removed the gravelly terrace material. The Grail soil is in troughs and depressions between the gravelly ridges and in drainageways that have seeps and springs. The Wayden and Grail soils in this complex have profiles similar to the ones described as representative of their respective series, but they are steeper.

Included with these soils in mapping are about 20 percent Judith gravelly loam on the gravelly ridges and terrace escarpments, and about 10 percent Regent silty clay loam and Shaak silty clay loam.

Runoff is medium, and the hazard of erosion is moderate. These soils are suited to range, recreation, watershed, and game range. Capability unit VIe-1 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.



**Wayden-Judith silty clay loams, hilly (WH).**—This complex is made up of hilly and steep soils on deeply dissected sedimentary uplands. It is about 50 percent Wayden silty clay loam; 30 percent Judith gravelly loam; and 20 percent Regent silty clay loam, Grail clay loam, and Shaak silty clay loam. Slopes are mostly 15 to 35 percent, but they range to 8 percent. The Judith soil is on gravelly ridges and in a band on the terrace escarpments. The Wayden soil is on gravel-free ridges and side slopes. The Grail soil is marked by patches of brush and is at the head and in the bottoms of drainageways and on northeast-facing terrace edges. Slopes are 8 to 15 percent on the Judith and Grail soils and 15 to 25 percent on the Wayden soil. The Judith soil in this complex has a profile similar to the one described as representative of the Judith series, but it is steeper, and the surface layer is gravelly loam.

Runoff is rapid, and the hazard of erosion is severe. These soils are used for range, recreation, watershed, and wildlife. Capability unit VIe-1 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**Wayden-Regent silty clay loams, hilly (WI).**—This complex is made up of hilly and steep soils on deeply dissected sedimentary uplands. It is 50 percent Wayden silty clay loam, 25 percent Regent silty clay loam, 10 percent Shale outcrop, and 15 percent Savage and Cherry silty clay loams. The Wayden soil is on narrow ridges and side slopes and has slopes of 30 percent or more. The Regent soil is on broad ridges, in tributary valleys, and on the north sides of ridges. It has slopes of 15 to 30 percent. The Savage and Cherry soils are on foot slopes. The Wayden and Regent soils in this complex have profiles similar to the ones described as representative of their respective series, but they are steeper.

Runoff is rapid, and the hazard of erosion is severe. These soils are used for range, recreation, watershed, and game range. Capability unit VIe-1 dryland; Thin Hilly range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**Wayden-Savage silty clay loams, rolling (WK).**—This complex is made up of rolling and hilly soils on deeply dissected sedimentary uplands. It is 45 percent Wayden silty clay loam, 30 percent Savage silty clay loam, and 25 percent Regent silty clay loam. Slopes are mostly 8 to 15 percent, but they range to 20 percent. The Wayden soil is on narrow ridges and knolls. The Savage soil is on foot slopes, bottoms, and fans. The Regent soil is on the north sides of low ridges. The Wayden and Savage soils in this complex have profiles similar to the ones described as representative of their respective series, but they are steeper.

Runoff is medium, and the hazard of erosion is moderate. These soils are used for wildlife, recreation, watershed, range, hay, and pasture. Capability unit IVe-2 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 2M.

**Wayden-Rock outcrop complex, rolling (WL).**—This complex is made up of rolling soils on deeply dissected sedimentary uplands. It is 55 percent Wayden silty clay loam, 35 percent Regent silty clay loam and Savage silty clay loam, and 15 percent Rock outcrop. Slopes are 8 to 15 percent. The Wayden soil is on narrow

ridges and hills. The Regent soil is on broad ridges. The Savage soil is on fans, foot slopes, and the bottoms of narrow drainageways. Rock outcrop is on peaks of narrow ridges and in eroded drainageways.

Runoff is medium, and the hazard of erosion is moderate. These soils are used for range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 3M.

**Wayden-Rock outcrop complex, hilly (WM).**—This complex is made up of hilly and steep soils on deeply dissected sedimentary uplands. It is 60 percent Wayden silty clay loam, 20 percent Rock outcrop, and 20 percent Regent silty clay loam and Savage silty clay loam. Slopes are mostly 15 to 25 percent, but they range to 35 percent. The Wayden soil is on narrow shale ridges and steep slopes. The Regent soil is on broad ridges. The Savage soil is on fans, foot slopes, and the bottoms of narrow drainageways. Rock outcrop is on peaks of narrow ridges and in steep, eroded drainageways. The Wayden soil in this complex has a profile similar to the one described as representative of the series, but it is steeper.

Runoff is rapid, and the hazard of erosion is severe. These soils are used for range, recreation, wildlife, and watershed. Capability unit VIe-1 dryland; Thin Hilly range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**Wayden-Shale outcrop complex, very steep (WN).**—This complex is made up of very steep soils on deeply dissected sedimentary uplands. It is about 50 percent Wayden silty clay loam and 50 percent Shale outcrop. Slopes are mostly 35 to 90 percent, but they range to 25 percent. The Wayden soil is on ridges and hills where slopes range from 25 to 55 percent. Shale outcrop is on the points of ridges, the lower sides of hills and ridges, and the sides of eroding drainageways. It has slopes of 50 to 90 percent. The Wayden soil in this complex has a profile similar to the one described as representative of the series, but it is steeper.

Runoff is rapid, and the hazard of erosion is severe. Runoff waters carry large amounts of sediment. These soils are used for range, wildlife, recreation, and watershed. Capability unit VIIe-1 dryland; Shale range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**Wayden complex, hilly (WO).**—This complex is made up of hilly and steep soils on deeply dissected sedimentary uplands. It is about 60 percent Wayden silty clay loam, 20 percent Rock outcrop, and 20 percent Dast stony sandy loam, Castner loam, and Reeder loam. The Wayden soil is between the sandstone ledges on the hilly valley side slopes where slopes are mostly 15 to 25 percent but range to 35 percent. The Castner soil is on hilltops above the ledges. The Dast soil is below the sandstone ledges. The Wayden soil in this complex has a profile similar to the one described as representative of the series, but it is steeper. Included in mapping are areas of a soil that have a light reddish-brown subsoil.

Runoff is rapid, and the hazard of erosion is severe. These soils are used for range, wildlife, recreation, and watershed. Capability unit VIIe-1 dryland; Thin



Breaks range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

### Wibaux Series

The Wibaux series consists of shallow, undulating to very steep, excessively drained soils on dissected sedimentary uplands. Slopes range from 4 to 90 percent. These soils formed in material weathered in place from red burned shale and porcelanite. Elevation ranges from 3,400 to 4,100 feet.

The native vegetation is mainly bluebunch wheatgrass, needleandthread, fringed sagewort, broom snakeweed, and rubber rabbitbrush. Annual precipitation is 11 to 13 inches, the average annual soil temperature is 49° to 52° F, and the frost-free period is 110 to 120 days.

In a representative profile the surface layer is reddish-brown channery loam about 2 inches thick. The underlying material is reddish-brown channery loam and very channery loam. Hard, red shale and sandstone are at a depth of about 9 inches.

Permeability is moderate, and available water capacity is very low. The effective rooting depth is about 10 inches. These soils are used for range, wildlife, recreation, and watershed.

Representative profile of Wibaux channery loam, in an area of Wibaux-Spearman complex, rolling, in grassland, 1,400 feet east and 200 feet south of the NW. corner sec. 23, T. 7 S., R. 40 E.

A—0 to 2 inches, reddish-brown (2.5YR 5/4) channery loam, dark reddish brown (2.5YR 3/4) moist; weak, thin, platy structure; soft, friable, nonsticky and slightly plastic; 25 percent (volume) thin, hard shale fragments of channer size; clear, smooth boundary.

C1—2 to 5 inches, reddish-brown (2.5YR 4/4) channery loam, dark reddish brown (2.5YR 3/4) moist; weak, medium, blocky structure; slightly hard, friable, slightly sticky and slightly plastic; 25 percent (volume) shale fragments of channer size; clear, wavy boundary.

C2—5 to 9 inches, reddish-brown (2.5YR 5/4) very channery loam, reddish brown (2.5YR 4/4) moist; massive; slightly hard, friable slightly sticky and slightly plastic; 65 percent (volume) hard shale fragments of channer size; slightly effervescent; abrupt, irregular boundary.

R—9 to 12 inches, fractured, hard, red shale and sandstone.

Depth to bedrock ranges from 8 to 20 inches. The soil ranges from 15 to 70 percent coarse fragments but averages 65 percent. The A horizon is brown, dark brown, and reddish brown in hue of 2.5YR to 7.5YR. The C horizon is weak red, reddish brown, light reddish brown, and light brown in hue of 7.5YR to 10R.

**Wibaux loam, hilly (Wp).**—This hilly and steep soil is in 40- to 300-acre areas on dissected burned shale highlands. It occupies hills, ridges, and valley sides. Slopes are 15 to 35 percent. The soil has a profile similar to the one described as representative of the series, but the surface layer is loam. Included in mapping are a few outcrops of red shale and porcelanite boulders on the steep soils on hillsides.

Runoff is rapid, and the hazard of erosion is severe. This soil is used for range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Shallow range site, 10- to 14-inch precipitation zone; windbreak suitability group 3M.

**Wibaux-Spearman complex, rolling (Wr).**—This complex is made up of rolling soils on dissected sedimentary uplands. It is 55 percent Wibaux channery loam, 40 percent Spearman loam, and 5 percent Chugter loam. Slopes are 8 to 15 percent. The Wibaux soil is on ridges and hills and along the edges of drainageways. The Spearman soil is in drainageways and on broad ridges. The Chugter soil is in the bottoms of drainageways. The Wibaux soil in this complex has the profile described as representative of the Wibaux series. The Spearman soil has a profile similar to the one described as representative of the Spearman series, but it is steeper. Included in mapping are outcrops of shale and sandstone and areas of Hydro loam.

Runoff is medium, and the hazard of erosion is moderate. These soils are used for range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Shallow range site, 10- to 14-inch precipitation zone; windbreak suitability group 3M.

### Windham Series

The Windham series consists of deep, gently sloping to very steep and hilly, well-drained soils on deeply dissected high terraces and fans. Slopes range from 4 to 75 percent. These soils formed in strongly calcareous gravelly loam and clay loam alluvium derived from limestone, siltstone, and quartzite rock. Elevation ranges from 3,900 to 5,200 feet.

The native vegetation is mainly slender wheatgrass, bluegrass, Hoods phlox, cudweed sagewort, and prairie junegrass. Annual precipitation is 15 to 18 inches, the average annual soil temperature is 45° to 47° F, and the frost-free period is 90 to 110 days.

In a representative profile the surface layer is dark grayish-brown gravelly loam about 5 inches thick. The upper part of the underlying material is dark grayish-brown and light brownish-gray gravelly loam. The lower part is very pale brown very gravelly loam and very gravelly clay loam that extends to a depth of 60 inches or more. Limestone fragments of gravel and cobble size make up about half the volume of the underlying material.

Permeability is slow, and available water capacity is low. The effective rooting depth is 50 inches or more. These soils are used for range, wildlife recreation, and watershed.

Representative profile of Windham gravelly loam, in an area of Windham-Norbert complex, 15 to 50 percent slopes, in grassland, in the center of sec. 31, T. 7 S., R. 34 E.

A—0 to 5 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark brown (10YR 2/2) moist; weak, medium, granular structure; soft, very friable, nonsticky and slightly plastic; 30 percent (volume) limestone fragments of pebble size; slightly effervescent; clear, smooth boundary.

C1—5 to 8 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak, fine, subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; 40 percent (volume) limestone fragments of pebble and cobble size; strongly effervescent; clear, wavy boundary.

C2—8 to 14 inches, light brownish-gray (10YR 6/2) gravelly loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly



plastic; 45 percent (volume) limestone fragments of pebble and cobble size; strongly effervescent; clear, wavy boundary.

- C3ca—14 to 23 inches, very pale brown (10YR 8/3) very gravelly loam, pale brown (10YR 6/3) moist; massive; hard, friable, slightly sticky and slightly plastic; 50 percent (volume) limestone fragments of pebble and cobble size; violently effervescent; lime coatings on pebbles; clear, wavy boundary.
- C4ca—23 to 37 inches, very pale brown (10YR 7/3) very gravelly loam, pale brown (10YR 6/8) moist; massive; soft, very friable, slightly sticky and slightly plastic; 60 percent (volume) limestone fragments of pebble and cobble size; strongly effervescent; lime coatings on pebbles; gradual, wavy boundary.
- C5ca—37 to 60 inches, very pale brown (10YR 7/3) very gravelly clay loam, light brownish gray (10YR 6/2) moist; massive; hard, friable, sticky and plastic; 55 percent (volume) limestone fragments of pebble and cobble size; strongly effervescent; lime coatings on pebbles.

The soil between depths of 10 and 40 inches is light clay loam or heavy loam and ranges from 50 to 70 percent coarse fragments of pebble and cobble size. Hue is 10YR or 7.5YR throughout. The A horizon is dark grayish-brown, grayish brown, and brown loam, gravelly loam, or cobbly loam. The Cca horizon is pink, pinkish white, very pale brown, and light gray.

**Windham cobbly loam, 15 to 35 percent slopes (Ws).**

—This moderately steep and steep soil is on deeply dissected gravelly benches. Areas are narrow and several thousand feet long. Local relief ranges from 10 to 50 feet. Slopes are 50 to 100 feet long. The soil has a profile similar to the one described as representative of the series, but about 25 to 35 percent of the coarse fragments are cobbles. Included in mapping are areas of Judith cobbly loam and Eltsac clay.

Runoff is rapid, and the hazard of erosion is severe. This soil is used for range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Shallow to Gravel range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**Windham complex, 15 to 35 percent slopes (WT).**

—This complex is made up of moderately steep and steep soils on deeply dissected gravelly benches that are underlain by shale. It is about 50 percent Windham cobbly loam, 40 percent Judith cobbly loam, and 10 percent Danvers silty clay loam. The Windham soil is in drainageways, on narrow ridges, and on the lower edges of fans and foot slopes. The Judith soil is in a band below the residual soils on fans and foot slopes. It has slopes of 15 to 20 percent. The Windham and Judith soils in this complex have profiles similar to the ones described as representative of their respective series, but cobbles and stones cover 5 to 20 percent of the surface.

Runoff is rapid, and the hazard of erosion is high. These soils are used for range, recreation, watershed, and game range. Capability unit VIe-1 dryland; Thin Hilly range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**Windham-Arnegard complex, 15 to 35 percent slopes (WU).**—This complex is made up of moderately steep and steep soils on deeply dissected gravelly benches that are underlain by shale. It is about 40 percent Windham cobbly loam, 40 percent Arnegard loam, and 20 percent Lap channery loam. The Lap and Windham soils are at the bases of the mountains and on the tops of ridges. The Arnegard soil is on the sides of ridges

and in troughs between the ridges. The Windham and Arnegard soils in this complex have profiles similar to the ones described as representative of their respective series, but they are steeper, and the Windham soil has a cobbly surface.

Runoff is rapid, and the hazard of erosion is severe. These soils are used for range, recreation, watershed, and game range. Capability unit VIe-1 dryland; Thin Hilly range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**Windham-Norbert complex, 15 to 50 percent slopes (WV).**—This complex is made up of moderately steep and very steep soils on deeply dissected high gravel terraces that are underlain by shale. It is about 55 percent Windham gravelly loam and 45 percent Norbert clay. The Windham soil is on the upper parts of ridges and hills. The Norbert soil is on the lower parts of ridges and in drainageways where soft shale bedrock has been exposed. Scattered gravel is on the surface of the Norbert soil where it is just below areas of Windham soil. The Windham soil in this complex has the profile described as representative of the Windham series. Included in mapping is Shale outcrop in areas of the Norbert soil.

Runoff is rapid, and the hazard of erosion is severe. These soils are used for range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Thin Hilly range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**Windham-Wayden complex, 15 to 35 percent slopes (WW).**—This complex is made up of moderately steep and steep soils on deeply dissected terraces and benches that are underlain by shale. It is about 60 percent Windham cobbly loam and 40 percent Wayden silty clay loam. The Windham soil is on ridges and hills that are covered by gravelly material. The Wayden soil is on the lower parts of ridges where shale bedrock is near the surface. The Windham soil in this complex has a profile similar to the one described as representative of the Windham series, but the surface layer is cobbly.

Runoff is rapid, and the hazard of erosion is severe. These soils are used for range, wildlife, recreation, and watershed. Capability unit VIe-1 dryland; Thin Hilly range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

**Windham-Lap association, very steep (WX).**—This association is made up of moderately steep and very steep soils on deeply dissected gravelly benches that are underlain by shale. It is 40 percent Lap very stony loam, 55 percent Windham stony and very stony loam, and 5 percent Rock outcrop. Slopes are mostly 35 to 75 percent, but they range to 15 percent. The Windham soil is on the upper parts of ridges and hills and below the rock ledges. The Lap soil is in bands above the rock ledges and on sharp spur ridges. The Windham and Lap soils in this association have profiles similar to the ones described as representative of their respective series, but the surface layer is stony and very stony.

Runoff is rapid, and the hazard of erosion is severe. These soils are used for game range, recreation, watershed, and range. Capability unit VIIe-1 dryland;



Thin Hilly range site, 15- to 19-inch precipitation zone; windbreak suitability group 4.

### Winnett Series

The Winnett series consists of moderately deep, undulating, well-drained, sodium-affected soils in the sedimentary uplands. Slopes range from 4 to 8 percent. These soils formed in place in material weathered from alkaline clay loam and silty clay loam shale. Elevation ranges from 3,300 to 3,700 feet.

The native vegetation is mainly milkvetch, Sandberg bluegrass, big sagebrush, greasewood, prairie junegrass, and western wheatgrass. Annual precipitation is 13 to 14 inches, the average annual soil temperature is 47° to 49° F, and the frost-free period is 110 to 120 days.

In a representative profile the surface layer is light brownish-gray loam about 5 inches thick. The subsoil is grayish-brown, light olive-brown, and olive clay about 17 inches thick. The substratum is pale-olive clay loam. Interbedded clay shale, siltstone, and sandstone are at a depth of about 26 inches.

Permeability is very slow, and available water capacity is low or moderate. The effective rooting depth is about 26 inches. These soils are used for range, wildlife, recreation, and watershed.

Representative profile of Winnett loam, in an area of Winnett complex, undulating, in grassland, 2,200 feet south and 25 feet west of the center of sec. 5, T. 3 S., R. 35 E.

- A21—0 to 2 inches, light brownish-gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, friable, slightly sticky and slightly plastic; many very fine and micro roots; common very fine and micro pores; clear, smooth boundary.
- A22—2 to 5 inches, light brownish-gray (2.5Y 6/2) heavy loam, dark grayish brown (2.5Y 4/2) moist; moderate, thin, platy structure; hard, friable, sticky and slightly plastic; many very fine and micro roots; few micro pores; abrupt, smooth boundary.
- B21t—5 to 11 inches, grayish-brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate, coarse, prismatic structure; very hard, very firm, very sticky and very plastic; common micro roots; few micro pores; moderately thick clay films on peds; tops of the prisms coated with clean sand and silt grains that are light brownish-gray (2.5Y 6/2) dry; gradual, wavy boundary.
- B22t—11 to 15 inches, light olive-brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) moist; moderate, medium, prismatic structure parting to moderate, medium, blocky; very hard, very firm, very sticky and very plastic; common micro roots; moderately thick, patchy clay films on peds; very slightly effervescent; few fine gypsum crystals; clear, wavy boundary.
- B3csca—15 to 22 inches, olive (5Y 5/3) clay, olive (5Y 4/3) moist; weak, medium, prismatic structure parting to weak, medium, blocky; very hard, very firm, very sticky and very plastic; common very fine roots; few very fine pores; slightly effervescent; common fine masses of gypsum crystals; few fine, soft lime masses.
- C1cs—22 to 26 inches, pale-olive (5Y 6/3) clay loam, olive (5Y 4/3) moist; weak, coarse, blocky structure; very hard, firm, very sticky and plastic; few fine roots; few micro pores; slightly effervescent; few fine gypsum crystals; diffuse, wavy boundary.
- C2—26 inches, pale-olive (5Y 6/3) interbedded clay shale, siltstone, and sandstone, olive (5Y 5/4) moist.

Depth to shale ranges from 20 to 40 inches, and depth to the Bcsca horizon, from 12 to 18 inches. Estimated exchangeable sodium ranges from 8 to 15 percent in the B2t horizon and from 15 to 25 percent in the Bcs and C horizons. The A2 and B2t horizons have hue of 10YR or 2.5Y. The B2t horizon is 45 to 55 percent clay. The C horizon is light yellowish brown and pale olive in hue of 5Y or 2.5Y.

**Winnett complex, undulating (Wy).**—This complex is made up of undulating soils on ridges and hills in the shale highlands. It is about 70 percent Winnett loam and 30 percent Bone clay. Slopes are 4 to 8 percent. The Bone soil is in barren microdepressions, 8 to 10 inches below the level of the Winnett soil. The Bone soil in this complex has a profile similar to the one described as representative of the series, but shale bedrock is at a depth of 24 inches.

Runoff is medium, and the hazard of erosion is moderate. These soils are used for range, wildlife, and watershed. Capability unit VIe-1 dryland; Pan Spots range site, 10- to 14-inch precipitation zone; windbreak suitability group 3S.

### Xavier Series

The Xavier series consists of deep, gently undulating to rolling, well-drained soils on fans, terraces, and high benches. Slopes range from 2 to 15 percent. These soils formed in silty alluvium and eolian sediment. Elevation ranges from 3,800 to 4,200 feet.

The native vegetation is mainly western wheatgrass, slender wheatgrass, green needlegrass, prairie junegrass, and big sagebrush. Annual precipitation is 15 to 16 inches, the average annual soil temperature is 45° to 47° F, and the frost-free period is 95 to 105 days.

In a representative profile the surface layer is grayish-brown silty clay loam and silt loam about 5 inches thick. The subsoil is dark-brown and pale-brown silty clay loam about 11 inches thick. The substratum is pale-yellow and light yellowish-brown silt loam that extends to a depth of 62 inches or more.

Permeability is moderate, and available water capacity is high. The effective rooting depth is 60 inches or more. These soils are used for dryfarmed and irrigated crops, range, wildlife, recreation, and watershed.

Representative profile of Xavier silty clay loam, undulating, in grassland, 2,000 feet north and 65 feet east of the center of sec. 18, T. 5 S., R. 33 E.

- A11—0 to 3 inches, grayish-brown (10YR 5/2) light silty clay loam, dark brown (10YR 3/3) moist; weak, thin, platy structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; many unstained silt and very fine sand grains; clear, smooth boundary.
- A12—3 to 5 inches, grayish-brown (10YR 5/2) heavy silty loam, dark brown (10YR 3/3) moist; weak, fine, blocky structure; hard, friable, sticky and slightly plastic; many very fine roots; clear, smooth boundary.
- B21t—5 to 10 inches, dark-brown (10YR 4/3) heavy silty clay loam, dark brown (10YR 3/3) moist; moderate, medium, prismatic structure parting to strong, blocky; very hard, firm, sticky and plastic; common very fine roots; many very fine pores; patchy clay films on peds; clear, smooth boundary.
- B3—10 to 16 inches, pale-brown (10YR 6/3) silty clay loam, dark brown (10YR 4/3) moist; moderate, medium, prismatic structure parting to moderate, me-



dium blocky; hard, friable, sticky and plastic; common very fine roots; common very fine pores; slightly effervescent; gradual, wavy boundary.

C1ca—16 to 27 inches, pale-yellow (2.5Y 7/4) silt loam, light olive brown (2.5Y 5/4) moist; weak, coarse, prismatic structure parting to moderate, medium, blocky; hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine pores; strongly effervescent; common fine lime threads and soft lime masses; gradual, wavy boundary.

C2ca—27 to 36 inches, light yellowish-brown (2.5Y 6/4) silt loam, olive brown (2.5Y 4/4) moist; weak, coarse, prismatic structure parting to weak, coarse, blocky; hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine pores; strongly effervescent; few fine lime threads and soft lime masses; diffuse, wavy boundary.

C3—36 to 62 inches, light yellowish-brown (2.5Y 6/4) silt loam, olive brown (2.5Y 4/4) moist; massive; hard, friable, slightly sticky and slightly plastic; strongly effervescent.

Depth to the B3 or C horizon ranges from 6 to 10 inches. Hue is 10YR or 2.5Y throughout. A few fine pebbles are at any depth in places. The A1 horizon ranges from grayish brown to light brownish gray. The B2t horizon is 35 to 45 percent clay. The Cca horizon is pale olive, light yellowish brown, and light gray.

**Xavier silty clay loam, gently undulating (Xa).**—This gently undulating soil is on high benches and terraces. Relief of the surface undulations is 5 to 20 feet. The soil has a profile similar to the one described as representative of the series, but it is less sloping. Included in mapping are spots of Savage silty clay loam and Belfield silt loam.

Runoff is slow, and the hazard of erosion is slight. This soil is used for irrigated and dryfarmed crops, hay, wildlife, watershed, recreation, and range. Capability unit IIe-2 dryland, IIe-1 irrigated; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Xavier silty clay loam, undulating (Xc).**—This undulating soil is on benches and terraces. Drainage-ways make local relief of 10 to 25 feet. The soil has the profile described as representative of the series. Included in mapping are spots of Savage silty clay loam and Belfield silt loam.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for irrigated and dryfarmed crops, hay, wildlife, watershed, recreation, and range. Capability unit IIIe-2 dryland, IIIe-1 irrigated; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Xavier silty clay loam, rolling (Xe).**—This rolling soil is on the eroded edges of terraces and benches and short fans below them. The fans below consist of material washed from the terrace. The soil has a profile similar to the one described as representative of the series, but it is gravelly.

Included with this soil in mapping are areas of Savage silty clay loam and Maschetah gravelly silt loam making up about 15 percent and 10 percent, respectively, of the area of this mapping unit.

Runoff is rapid, and the hazard of erosion is severe. This soil is used for dryfarmed crops, hay, pasture, wildlife, watershed, recreation, and range. Capability unit IVe-2 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Xavier-Shaak complex, undulating (Xh).**—This complex is made up of undulating soils on dissected ter-

aces that are underlain by sedimentary bedrock. It is about 60 percent Xavier silty clay loam and 40 percent Shaak silty clay loam. The Xavier soil is on ridges and northwest-facing hillsides. The Shaak soil is on east- and south-facing hillsides.

Runoff is medium, and the hazard of erosion is moderate. These soils are used for dryfarmed crops, hay, wildlife, watershed, recreation, and range. Capability unit IIIe-2 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

**Xavier-Shaak complex, rolling (Xk).**—This complex is made up of rolling soils on dissected terraces that are underlain by sedimentary bedrock. It is about 50 percent Xavier silty clay loam, 40 percent Shaak silty clay loam, and 10 percent Maschetah silt loam. Slopes are 8 to 15 percent. The Xavier soil is on the hilltops and ridgetops and the west and north sides of hills and ridges. The Shaak soil is on the east and south sides of hills and ridges. The Maschetah soil is on narrow ridges and the edges of drainageways. The Xavier and Shaak soils in this complex have profiles similar to the ones described as representative of their respective series, but they are steeper.

Runoff is medium, and the hazard of erosion is moderate. These soils are suited to dryfarmed crops, hay, pasture, wildlife, watershed, recreation, and range. Capability unit IVe-2 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

## Use and Management of the Soils

The soils of the Big Horn County Area are used mainly for pasture and range and for irrigated and nonirrigated crops. This section of the survey explains how the soils can be managed for these purposes as well as for windbreaks, woodland, recreation, and wildlife and for building highways, farm ponds, and other engineering structures. It also shows predicted yields of the principal irrigated and nonirrigated crops. Information on crops is given by describing general practices suitable for all soils, then by grouping the soils that require similar management, describing the group, and suggesting suitable management practices.

## Management for Irrigated Crops

About 59,672 acres in the Area was irrigated in 1967. The main irrigated crops are winter wheat, spring wheat, barley, oats, corn for grain and silage, sugar beets, dry beans, alfalfa hay, and pasture. The most common needs in managing irrigated soils are practices for maintaining fertility, using water efficiently, and controlling erosion.

The soils have a low to medium content of nitrogen and phosphorus. Including legumes in the cropping system (7) and applying nitrogen and phosphorus fertilizers help correct this deficiency. Mineral fertilizer supplements the natural supply during the year it is applied (4). Part of the phosphorus fertilizer applied one year may be left over for future years, but nitrogen fertilizer generally is not. The residual benefit of fertilizer varies with crop response. Nitrogen fertilizer



is lost readily through excessive use of irrigation water. Barnyard and green manure help to increase organic matter and fertility, improve soil structure, and increase the water intake rate of clayey soils. Fall plowing is better for the clayey soils than spring plowing.

Irrigation systems are chosen to provide optimum control and distribution of water at minimum cost and labor. Overirrigation wastes water, leaches plant nutrients, and may erode the soil. Overirrigation can also create drainage problems, raise the water table, and increase soil salinity. The risk of erosion is greater on steep soils than on more nearly level ones. On some soils, as the surface layer is removed by erosion, sub-surface layers that contain a large amount of carbonates or soluble salts may be exposed and mixed in the plow layer. This situation tends to reduce crop yields and increase the cost of management.

### Management for Nonirrigated Crops

About 189,672 acres in the Big Horn County Area was dryfarmed in 1967. Winter wheat and barley are the major dryfarm crops. Alfalfa hay, grass hay, and oats are also grown. Where the annual precipitation in the Area is 12 to 16 inches, conservation of water is the main concern in managing dryfarmed soils. If 8 to 12 inches of water is available in the soil during the growing season, crops can be expected to grow well.

Most dryfarmed soils have moderate fertility, but nitrogen and phosphorus fertilizers may be needed. Fertility is highest immediately after the soils are plowed out of sod. Burning the stubble temporarily increases crop yields but is ultimately harmful because it destroys the crop residue that restores organic matter to the soil.

The most common cropping system is small grain one year and fallow the next (5). Grasses and legumes can be grown on all dryfarmed soils (3). Fallow tillage helps to eliminate weeds, store moisture, and control soil blowing (6). Tilling is done mostly with sweeps, chisel implements, and rod weeders. Such implements leave crop residue on the surface, which helps to control erosion.

Soil blowing and water erosion can be controlled by protecting the surface with stubble mulch, by strip-cropping, by planting a cover crop on steep slopes, and by keeping a good stand of grass in pastures. Large fields can be strip-cropped, but some fields are too small or too irregular in shape to strip-crop. Soils that have slopes of 2 to 4 percent may be suited to contour plowing. Stubble-mulch tillage is needed on sandy soils, such as Alice fine sandy loam, and a permanent cover of grass is needed in large areas of steep, thin, or sandy soils. Grasses should be grown as cover in drainageways to help control erosion.

### Management of Saline and Alkali Soils

Approximately 10,000 acres of irrigated land in the Big Horn County Area have harmful accumulations of salt. Some areas that are affected by salts are not irrigated.

Weathering of primary minerals is the indirect source of nearly all soluble salts; however, there are few places where harmful accumulations of salts result from this source alone. Salt generally accumulates in arid areas that receive salts from other locations. Salts move into these areas in surface and ground water. Topography, restricted drainage, low permeability, high water table, seepage in irrigation canals and ditches, overirrigation, and salts in irrigation water are all contributing factors.

Saline soils contain soluble salts in amounts that impair the germination of seeds and growth of plants. They frequently have a white surface crust of salt. They do not have significant amounts of exchangeable sodium. Excess salts and lack of exchangeable sodium keep these soils generally flocculated; as a result, permeability to air and water is satisfactory.

Saline soils can be reclaimed by removal of excess salts. If drainage is adequate, salts can be removed by leaching with water. This is done by ponding water on the soil or by overirrigating. Incorporating organic material, such as manure and cover crops, or any practices that improve the surface tilth and increase water infiltration facilitates the reclamation of these soils.

Alkali soils do not contain a harmful amount of soluble salts but are more than 15 percent exchangeable sodium. The clay in these soils is dispersed, and this dispersion increases as the proportion of exchangeable sodium increases. Such soils have a high shrink-swell potential, very slow water infiltration rate, and slow permeability to water and air.

Saline-alkali soils contain a harmful amount of soluble salts and more than 15 percent exchangeable sodium. So long as the excess salts are present, the appearance and properties of these soils are similar to those of the saline soils. If the excess salts are removed, these soils take on characteristics similar to those of the alkali soils.

Reclamation of alkali and saline-alkali soils is difficult. Each area has a unique combination of kinds and amount of salts, cations, and exchangeable sodium. No single method of reclamation applies in all cases. Thorough sampling and testing of the soils are necessary to determine what combination of methods is needed. If the sodium is concentrated near the surface in scattered pans or slickspots, the soil may be reclaimable by deep plowing or by spreading large amounts of gypsum or sulphur and organic matter on the spots. Reclamation of these soils requires not only the leaching of soluble salt, but the replacing of exchangeable sodium with calcium. A source of calcium must be provided, and movement of water through the soil must be maintained to remove excess salt.

Reclamation of saline, saline-alkali, and alkali soils is not always feasible or practical. Crop production can be improved and farm income increased in many salt-affected areas by using suitable practices. Among the beneficial management practices on these soils are careful application of irrigation water to surrounding soils, land leveling to improve application of irrigation water, selection of salt-tolerant crops, use of special planting techniques and seedbed preparation to minimize salt accumulation around the seeds, keeping the



soil moderately moist, providing periodic leaching of soil and at the same time controlling water applications so that the water table is not raised appreciably, maintaining water system conveyance and drainage systems, leaching pre-emergence irrigation to reduce salt content for better seed germination, tilling soils that have exchangeable sodium with caution to prevent unnecessary puddling of the surface layer, and use of soil amendments, organic matter, and sod crops to improve soil structure as needed.

Where salinity cannot be entirely eliminated, crops that produce satisfactorily under existing saline conditions can be selected. In selecting crops for salt-affected soils, particular attention should be given to the salt tolerance of the crops during germination, because poor results are frequently caused by failure to obtain a satisfactory stand. Some crops that are salt tolerant during the later stages of growth are quite sensitive to salinity during germination.

Among the highly tolerant crops are barley, sugar beets, and western wheatgrass. Crops that have low salt tolerance include beans, alsike, red clover, and ladino clover.

The control of salinity and alkalinity is generally accomplished most easily in the sandy textured soils. These soils are more rapidly permeable and are less likely to deteriorate in tilth than are the more clayey soils. Loam and clay loam soils have a greater available water capacity, and salinity is generally not difficult to control if the soils have good structure and are underlain by permeable soil material. Prevention of salt accumulations or reclamation of saline-affected soils is most difficult in clay soils that have slowly permeable material extending to a considerable depth.

## Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are so used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

In the capability system, the kinds of soils are grouped at three levels: the capability class, the subclass, and the unit. These groupings are described in the following paragraphs.

**CAPABILITY CLASSES**, the broadest groups, are designated by Roman numerals I to VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife habitat.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture, range, woodland, or wildlife habitat.

Class VII soils have very severe limitations that make them unsuited to cultivation and restrict their use largely to pasture, range, woodland, or wildlife habitat.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife habitat, water supply, or esthetic purposes.

**CAPABILITY SUBCLASSES** are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral; for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

Class I has no subclass, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, although they have other limitations that restrict their use largely to pasture, range, woodland, wildlife habitat, or recreation.

**CAPABILITY UNITS** are soil groups within the subclasses. The soils in one capability unit are enough to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-6. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.



In the following pages the capability units in the Big Horn County Area are described, and suggestions for the use and management of the soils are given.

### ***Irrigated capability units***

In this section each irrigated capability unit is described, soil characteristics and hazards of management are discussed, and suitable crops and management practices are given.

#### **CAPABILITY UNIT IIc-1 IRRIGATED**

This unit consists of deep, well-drained, and nearly level, gently sloping, and gently undulating soils that formed in alluvium. They have a surface layer of loam, silt loam, or silty clay loam and underlying material of loam, clay loam, silty clay loam, and silty clay.

Permeability is moderate or moderately slow. Runoff is slow or medium, the hazard of erosion is slight or moderate, and available water capacity is moderate or high. The frost-free period is mostly 105 to 125 days, but in some areas it is as few as 90 days.

The main concerns of management are the moderately slow permeability and proper use of water to control water erosion on the more sloping soil. These soils are suited to most irrigated crops grown in the Area. Dry beans, sugar beets, and corn grown for grain are not suitable on these soils where the growing season is less than 115 days.

#### **CAPABILITY UNIT IIc-2 IRRIGATED**

This unit consists of deep, well-drained, gently sloping soils that formed in alluvium. They have a surface layer of fine sandy loam and underlying material of stratified fine sandy loam, sandy loam, and loamy sand.

Permeability is moderately rapid. Runoff is slow, the hazard of erosion is moderate, and available water capacity is moderate. The frost-free period is 120 to 125 days.

The main concerns of management are controlling water erosion and soil blowing and managing water on these moderately rapidly permeable soils. The soils are suited to most irrigated crops grown in the Area. Dry beans, sugar beets, and corn grown for grain are not suitable where the growing season is less than 115 days.

#### **CAPABILITY UNIT IIc-1 IRRIGATED**

This unit consists of deep, well-drained, nearly level soils that formed in alluvium. They have a surface layer of silt loam, clay loam, silty clay loam, or silty clay and underlying material of loam, silty clay loam, or silty clay.

Permeability is moderately slow or slow. Runoff is slow, the hazard of erosion is slight, and available water capacity is moderate or high. The frost-free period is mostly 105 to 125 days.

These soils require timely tillage where the surface layer is silty clay loam or silty clay. Good water management is needed because of the moderately slowly and slowly permeable subsoil. These soils are suited to most of the irrigated crops grown in the Area. Sugar beets, corn grown for grain, and dry beans are not

suitable where the frost-free period is less than 115 days.

#### **CAPABILITY UNIT IIc-2 IRRIGATED**

This unit consists of deep, well-drained, nearly level soils that formed in sandy alluvium. They have a surface layer of loam or fine sandy loam and underlying material of stratified fine sandy loam, sandy loam, and loamy sand.

Permeability is moderately rapid. Runoff is slow, the hazard of erosion is slight or moderate, and available water capacity is moderate. The frost-free period is 120 to 125 days.

The surface layer on about half of the acreage is fine sandy loam, and on the rest it is loam. Good management of the fine sandy loam soil is needed to prevent soil blowing. Water must be well managed because the soils are moderately rapidly permeable. The soils are suited to most of the irrigated crops grown in the Area. Sugar beets, corn grown for grain, and dry beans are not suitable where the frost-free period is less than 115 days.

#### **CAPABILITY UNIT IIc-1 IRRIGATED**

This unit consists of deep, well-drained, nearly level soils that formed in alluvium. They have a surface layer of loam, silt loam, clay loam, or silty clay loam and underlying material of loam, clay loam, silty clay loam, or silty clay.

Permeability is moderate. Runoff is slow, the hazard of erosion is slight, and available water capacity is moderate or high. The frost-free period is mostly 105 to 125 days, but in some areas it is as few as 95 days.

The surface layer on most of the acreage is silt loam or loam that is easy to till, but in some areas it is silty clay loam that needs timely tillage. Crops grown on these soils respond well to applications of fertilizer and to good water management.

These soils are suited to all irrigated crops grown in the Area, but corn grown for grain is a marginal crop at elevations of more than 3,500 feet.

#### **CAPABILITY UNIT IIc-2 IRRIGATED**

This unit consists of deep, well-drained, nearly level soils that formed in alluvium. They have a surface layer of silty clay loam and a subsoil of silty clay loam or silty clay.

Permeability is moderately slow. Runoff is slow, the hazard of erosion is slight, and available water capacity is moderate or high. The frost-free period is mostly 105 to 125 days, but in some areas it is as few as 95 days.

These soils need timely tillage because of their surface texture. They respond well to fertilizer. Good water management is needed because of the moderately slow permeability.

These soils are suited to all irrigated crops grown in the Area, but corn grown for grain is a marginal crop at elevations of more than 3,500 feet.

#### **CAPABILITY UNIT IIIc-1 IRRIGATED**

This unit consists of deep, well-drained, undulating and gently sloping soils that formed in alluvium. They have a surface layer of loam, clay loam, silt loam, or



silty clay loam and underlying material of loam, clay loam, silty clay loam, silty clay, or clay.

Permeability is mostly moderate or moderately slow, but in places it is slow. Runoff is medium, the hazard of erosion is moderate, and available water capacity is moderate or high. The frost-free season is mostly 105 to 125 days, but in some areas it is as few as 90 days.

The main concerns of management are controlling water erosion and managing water, especially on soils where permeability is moderately slow. These soils are well suited to most crops, hay, and pasture grasses commonly grown in the Area, but corn grown for grain and sugar beets are not suitable where the frost-free period is less than 115 days.

#### CAPABILITY UNIT IIIc-2 IRRIGATED

This unit consists of deep, well-drained, moderately sloping soils that formed in alluvium. They have a surface layer of fine sandy loam and underlying material of stratified fine sandy loam, sandy loam, and loamy sand.

Permeability is moderately rapid. Runoff is medium, the hazard of erosion is moderate, and available water capacity is moderate. The frost-free period is 120 to 125 days.

The main concerns of management are controlling soil blowing and water erosion and managing water. These soils are suited to most irrigated crops, hay, and pasture grasses commonly grown in the Area.

#### CAPABILITY UNIT IIIc-3 IRRIGATED

This unit consists of deep, well-drained, gently undulating soils that formed in alluvium. They have a surface layer of silty clay loam, silty clay, or clay and underlying material of silty clay or clay.

Permeability is slow or very slow. Runoff is slow or medium, the hazard of erosion is slight or moderate, and available water capacity is moderate or high. The frost-free period is mostly 105 to 125 days, but in some areas it is as few as 90 days.

The main concerns of management are the slow and very slow permeability, timely tillage, and proper use of water to control water erosion. These soils are suited to most irrigated crops, hay, and pasture grasses commonly grown in the Area. Corn grown for grain and sugar beets are not suitable where the frost-free period is less than 115 days.

#### CAPABILITY UNIT IIIc-1 IRRIGATED

This unit consists of deep, well-drained, nearly level soils that formed in alluvium. They have a surface layer of silty clay loam, silty clay, or clay and underlying material of silty clay or clay.

Permeability is very slow or slow. Runoff is slow, the hazard of erosion is slight, and available water capacity is moderate or high. The frost-free period is mostly 105 to 125 days, but in some areas it is as few as 90 days.

The moisture range within which these soils can be tilled is narrow, and the power requirement is high. Their very slow permeability makes them difficult to irrigate. Good irrigation practices and those that maintain soil structure are important for high crop yields.

These soils are suited to most irrigated crops grown in the Area, but corn grown for grain and sugar beets are not suitable where the frost-free period is less than 115 days.

#### CAPABILITY UNIT IVc-1 IRRIGATED

This unit consists of deep, well-drained, nearly level, undulating and gently sloping soils that formed in alluvium. They have a surface layer of clay loam, silty clay loam, or clay and underlying material of clay.

Permeability is slow or very slow. Runoff is slow or medium, the hazard of erosion is slight or moderate, and available water capacity is moderate or high. The frost-free period is mostly 105 to 125 days, but in some areas it is as few as 90 days.

The main concerns of management are the slowly or very slowly permeable subsoil, timely tillage of the surface layer, and managing irrigation water to prevent water erosion. These soils are suited to small grain, hay, pasture, and range.

#### CAPABILITY UNIT IVc-2 IRRIGATED

This unit consists of deep, well-drained, strongly sloping or rolling soils that formed in alluvium. They have a surface layer of silt loam or silty clay loam and underlying material of silty clay loam.

Permeability is moderate or moderately slow. Runoff is medium or rapid, the hazard of erosion is moderate to severe, and available water capacity is high. The frost-free period is mostly 110 to 125 days.

The main concerns of management are controlling water erosion and timely tillage of the silty clay loam soils. These soils are suited to small grain, hay, pasture, and range.

#### CAPABILITY UNIT IVc-1 IRRIGATED

This unit consists of deep, well-drained, nearly level and gently sloping soils that formed in alluvium. They have a surface layer of silty clay loam and clay and underlying material of clay.

Permeability is slow or very slow. Runoff is slow, the hazard of erosion is slight, and available water capacity is moderate or high. The frost-free period ranges from 115 to 125 days.

The main concerns of management are timely tillage and managing water. In some areas the soils have an uneven surface, which causes uneven water distribution. These soils are suited to small grain, hay, pasture, and range.

### **Dryland capability units**

In this section, each dryland capability unit is described, soil characteristics and hazards of management are discussed, and suitable crops and management practices are given.

#### CAPABILITY UNIT IIc-2 DRYLAND

This unit consists of moderately deep and deep, nearly level to gently sloping and undulating soils on fans, terraces, gravel- and loess-mantled benches, and shale highlands. The surface layer ranges from loam to clay.

These soils are well drained, and permeability is moderate to very slow. Available water capacity is



low to high, and runoff is slow to medium. On cultivated fields the hazards of water erosion and soil blowing are slight to moderate. The frost-free period is 90 to 125 days, and annual precipitation is 14 to 18 inches.

The soils in this unit are easy to till. Crops respond well to applications of nitrogen and phosphorus fertilizer.

These soils are used mostly for small grain, alfalfa and grass hay, and pasture. Small grain is commonly grown in a crop-fallow system but can be grown annually without fallow.

#### CAPABILITY UNIT IIc-2 DRYLAND

This unit consists of deep, nearly level soils on fans, terraces, and gravelly benches. The surface layer ranges from silt loam or clay loam to clay.

These soils are well drained, and permeability is very slow to moderate. Available water capacity is moderate or high, and runoff is slow. The frost-free period is 90 to 120 days, and annual precipitation is 14 to 17 inches.

The soils in this unit need extra care if they are cultivated. The power requirement is high. Good tilth is difficult to maintain where plowing extends into the clay subsoil. Water erosion is a slight hazard on all of the soils, and soil blowing is a moderate hazard on the bare, dry soils. All of the soils benefit from applications of nitrogen and phosphorus fertilizer.

These soils are used mostly for small grain, hay, and pasture. They are also suited to range. Crested wheatgrass, green needlegrass, western wheatgrass, Siberian wheatgrass, and brome grass are suitable for hay and pasture planting.

#### CAPABILITY UNIT IIc-2 DRYLAND

This unit consists of deep, nearly level soils on flood plains, terraces, fans, and gravelly high benches. They have a surface layer of silt loam, loam, and silty clay loam.

These soils are well drained, and permeability is moderate to moderately slow. Available water capacity is moderate or high, and runoff is slow. The hazards of soil blowing and water erosion are slight. The frost-free period is 95 to 125 days, and annual precipitation is 14 to 18 inches.

The soils in this unit are easy to till. Crops respond to applications of nitrogen and phosphorus fertilizer.

These soils are used mostly for small grain, alfalfa and grass hay, and pasture. Small grain is commonly grown in a crop-fallow system but can be grown annually without fallow.

#### CAPABILITY UNIT IIIc-2 DRYLAND

This unit consists of deep to moderately deep, nearly level to gently sloping and undulating soils on terraces, fans, foot slopes, gravelly high benches, and loess-mantled uplands. These soils range from fine sandy loam to clay.

These soils are well drained, and permeability is moderately rapid to very slow. Available water capacity is low to high, and runoff is slow to rapid. The hazard of water erosion is slight to moderate. Soil blowing is a hazard on benches near the mountains.

The frost-free period is 90 to 125 days, and annual precipitation is 14 to 18 inches.

The soils in this unit are easy to till. The soils on the valley foot slopes need diversion terraces to intercept runoff from soils above. The main watercourse should be in permanent sod. Crops respond to applications of nitrogen and phosphorus fertilizer.

These soils are used mostly for small grain, alfalfa and grass hay, and pasture. Small grain is commonly grown in a crop-fallow system but can be grown annually without fallow. Crested wheatgrass, smooth brome grass, Siberian wheatgrass, and green needlegrass are suitable for hay and pasture planting.

#### CAPABILITY UNIT IIIc-3 DRYLAND

This unit consists of deep and moderately deep, nearly level to sloping soils on stream terraces, fans, foot slopes, gravelly benches, and shale and sandstone highlands. These soils range from fine sandy loam to clay.

These soils are well drained, and permeability is moderately rapid to very slow. Available water capacity is low to high, and runoff is slow to rapid. The frost-free period is 90 to 125 days, and annual precipitation is 10 to 14 inches.

The soils in this unit have a slight to moderate hazard of water erosion. The soils that have a surface layer of sandy loam, silt loam, or clay are moderately susceptible to soil blowing. The soils on valley foot slopes need protection from runoff from soils above them. The watercourse needs to be sodded to prevent gullying.

These soils are mostly suited to dryfarmed small grain, hay, and pasture. They are also suited to range. Alfalfa, crested wheatgrass, and pubescent wheatgrass are suitable for hay and pasture planting. Green needlegrass is also suitable on the moderately fine textured and fine textured soils.

#### CAPABILITY UNIT IIIc-2 DRYLAND

This unit consists of deep, level soils in undrained basins and potholes in the shale highlands and on high gravel terraces.

These soils are poorly drained and somewhat poorly drained, and permeability is slow or very slow. Ponding is common early in spring. Available water capacity is moderate or high. The frost-free period is 105 to 125 days, and annual precipitation is 13 to 17 inches.

The soils in this unit have only a slight hazard of soil blowing. Surface drainage and control of surface water are needed on most areas. Crops may be lost from excessive moisture in some years.

These soils are suited mostly to dryfarmed small grain, hay, and pasture. They are also suited to range. Brome grass, western wheatgrass, and green needlegrass are suitable for hay and pasture planting.

#### CAPABILITY UNIT IIIc-2 DRYLAND

This unit consists of deep, nearly level soils on flood plains, terraces, and fans. These soils have a texture of loam or silty clay loam.

These soils are well drained, and permeability is moderate to slow. A seasonal high water table is within



a depth of 5 feet. The soils are moderately saline. Available water capacity is moderate or high, and runoff is slow. The hazard of erosion is slight. The frost-free period is 105 to 125 days, and annual precipitation is 12 to 15 inches.

The soils in this unit are easy to till, but they need careful management if they are used for crops. Drainage and the selection of such salt-tolerant crops as barley are recommended. Tall wheatgrass, birdsfoot trefoil, and western wheatgrass are suitable for hay and pasture plantings.

#### CAPABILITY UNIT IIIc-3 DRYLAND

This unit consists of deep, nearly level soils on fans and terraces. These soils are silty clay loam throughout.

These soils are well drained, and permeability is slow. Available water capacity is moderate or high, and runoff is slow. The frost-free period is 110 to 125 days, and annual precipitation is 12 to 15 inches.

These soils are difficult to till, and power costs are above average. To maintain good tilth, the soils must be tilled at the proper moisture content. Sodium-affected soils puddle and crust easily. All crop residue should be left on the surface of these soils. Water erosion is a slight hazard on all the soils, and soil blowing is a moderate hazard in cultivated areas. Crops respond well to applications of nitrogen and phosphorus fertilizer.

These soils are used for small grain, hay, and pasture. Crested wheatgrass, Siberian wheatgrass, green needlegrass, and western wheatgrass are suitable for hay and pasture planting.

#### CAPABILITY UNIT IIIc-1 DRYLAND

This unit consists of deep, nearly level soils on flood plains, terraces, fans, and gravelly high benches. The surface layer is loam, silt loam, and silty clay loam.

These soils are well drained, and permeability is moderate to slow. Available water capacity is moderate or high, and runoff is slow to medium. The frost-free period is 105 to 125 days, and annual precipitation is 11 to 15 inches.

The soils in this unit are easy to till. They have a slight to moderate hazard of water erosion and soil blowing. Crops respond to applications of nitrogen and phosphorus fertilizer if the soil is moist to a depth of 3 feet at seeding time and if precipitation early in spring is above normal.

These soils are used mostly for small grain, alfalfa and grass hay, and pasture. Crested wheatgrass, pubescent wheatgrass, and Russian wildrye are suitable for pasture planting.

#### CAPABILITY UNIT IVc-2 DRYLAND

This unit consists of shallow, moderately deep, and deep, mainly strongly sloping and rolling soils on fans, foot slopes, valley sides, high gravel- and loess-mantled benches, and shale and sandstone highlands. The surface layer ranges from sandy loam to clay.

These soils are well drained to excessively drained, and permeability is very slow to moderately rapid. Available water capacity is very low to high, and runoff is medium to rapid. Generally, the frost-free period

is 90 to 115 days, and annual precipitation is 14 to 18 inches. In some small areas the frost-free period is 60 to 80 days and annual precipitation is 18 to 24 inches.

The soils in this unit have a moderate to severe hazard of water erosion. The hazard of soil blowing is moderate on the soils that have a surface layer of silt loam, clay, or sandy loam. The deep and moderately deep soils are suitable for dryfarmed small grain only where the frost-free period is more than 90 days. Erosion control measures and diversion of runoff from higher soils are necessary. Unless drainageways are kept in sod, severe gulying results where runoff collects.

These soils are used mostly for pasture, hay, and range. Bromegrass, alfalfa, crested wheatgrass, green needlegrass, Siberian wheatgrass, and pubescent wheatgrass are suitable for hay and pasture planting. Intermediate wheatgrass is also suitable where annual precipitation is more than 16 inches.

#### CAPABILITY UNIT IVc-3 DRYLAND

This unit consists of shallow, moderately deep, and deep, nearly level to moderately steep soils on flood plains, terraces, fans, foot slopes, and shale and sandstone highlands. The surface layer ranges from fine sandy loam to clay.

These soils are well drained, and permeability is rapid to very slow. Available water capacity is very low to high, and runoff is slow to rapid. The frost-free period is 105 to 125 days, and annual precipitation is 12 to 14 inches.

The soils in this unit have a slight to severe hazard of water erosion. The hazard of soil blowing is moderate on soils that have a surface layer of clay, silt loam, or fine sandy loam. The deep and moderately deep soils are suitable for dryfarmed small grain only where erosion control measures are adequate and where runoff from adjacent, higher soils is diverted. Unless drainageways are kept in sod, severe gulying results where runoff collects.

These soils are used mostly for pasture, hay, and range. Bromegrass, alfalfa, crested wheatgrass, and pubescent wheatgrass are suitable for hay and pasture planting.

#### CAPABILITY UNIT IVc-2 DRYLAND

This unit consists of deep, nearly level soils on flood plains, low terraces, and fans. These soils are loam, silt loam, silty clay loam, and clay. They have a water table within 3 feet of the surface during part of the growing season.

Permeability is moderate to very slow, and in some areas the soils are moderately affected by salinity. Occasional overflow occurs early in spring. Available water capacity is moderate or high, and runoff is slow. The hazard of erosion is slight to severe. The frost-free period is 95 to 125 days.

These soils are suited to pasture and range.

#### CAPABILITY UNIT IVc-2 DRYLAND

This unit consists of shallow, moderately deep, and deep, nearly level to strongly sloping soils on terraces,



fans, flood plains, and shale highlands. The surface layer ranges from loam and gravelly loam to clay.

These soils are well drained, and permeability ranges from very slow to rapid. Available water capacity is very low to high, and runoff is slow to rapid. The hazard of water erosion is slight to severe. The frost-free period is 90 to 125 days, and annual precipitation is 11 to 14 inches.

These soils are suited to range and dryfarmed small grain. Some small areas of saline soils are suited to salt-tolerant grasses, such as tall wheatgrass. The silty clay and clay soils are hard when dry and very sticky and plastic when wet. They have a narrow moisture range at which they can be tilled. Brome grass, crested wheatgrass, Siberian wheatgrass, green needlegrass, and pubescent wheatgrass are suitable for hay and pasture planting.

#### CAPABILITY UNIT VIe-1 DRYLAND

This unit consists of shallow, moderately deep, and deep, gently sloping, strongly sloping, hilly, and steep soils on valley bottoms, terraces, loess-covered hills, and shale, sandstone, and limestone uplands. The surface layer ranges from sandy loam to clay and in places is gravelly and channery.

These soils are excessively drained to well drained, and permeability ranges from rapid to very slow. Available water capacity is very low to high, and runoff is medium to rapid. The frost-free period is 60 to 125 days, and annual precipitation is 11 to 24 inches.

The soils in this unit have a moderate to severe hazard of water erosion. The soils that have a surface layer of clay, loamy sand, and sandy loam are subject to moderate or severe soil blowing. Some areas are subject to streambank erosion and occasional overflow early in spring. A hard surface crust forms on sodium-affected soils as they dry. They are difficult to work, and seedling emergence is slowed.

Most of these soils occur as complexes in which shallow depth makes them unsuitable for cultivation. They are used mostly for range.

#### CAPABILITY UNIT VIw-1 DRYLAND

This unit consists of deep soils on flood plains, low terraces, and valley bottoms. They are loam and silty clay soils that are subject to flooding and that in places have a water table within 3 feet of the surface.

Permeability is slow to moderate, and available water capacity is moderate or high. Runoff is slow, and the hazard of erosion is severe during flooding. The frost-free period is 95 to 125 days, and annual precipitation is 12 to 15 inches.

These soils are suited only to range.

#### CAPABILITY UNIT VIe-1 DRYLAND

This unit consists of shallow, moderately deep, and deep, nearly level, gently sloping, sloping, and rolling soils on terraces, fans, valley bottoms, and limestone, shale, and sandstone uplands. These soils range from sandy loam to clay and in places are stony, gravelly, channery, and cobbly. Several of the soils are sodium and salt affected.

These soils are well drained, and permeability ranges from very slow to rapid. Available water capacity is

very low to high, and runoff is slow to medium. The frost-free period ranges from 60 to 125 days, and annual precipitation is 12 to 24 inches.

The soils in this unit have a slight to severe hazard of water erosion. The hazard of soil blowing is moderate on several of the soils. The clay soils are sticky and plastic when wet and very hard when dry. Surface crusting on the saline soils prevents seedling emergence, and such soils are suited only to salt-tolerant plants.

Most of these soils occur in complexes of two or more soils that differ widely in their suitability for crops and in management requirements. Consequently, they are used mostly for range. The moderately deep, stone- and gravel-free soils are suitable for pasture and hay. Crested wheatgrass, green needlegrass, and Siberian wheatgrass are suitable for pasture and hay planting where annual precipitation is less than 14 inches. In the areas of higher rainfall, pubescent wheatgrass, smooth brome grass, and intermediate wheatgrass are suitable.

#### CAPABILITY UNIT VIIe-1 DRYLAND

This unit consists of shallow, moderately deep, and deep, steep and very steep soils that are mixed with outcrops of limestone, shale, sandstone, and porcelanite on deeply dissected highlands. These soils range from clay to loam and include extremely stony, channery, and gravelly phases.

These soils are excessively drained to well drained, and permeability ranges from very slow to rapid. Available water capacity is very low in the shallow soils and low or moderate in the moderately deep and deep soils. Runoff is rapid, and the hazard of erosion is severe. Gully erosion is active in drainageways. Runoff water carries large amounts of sediment. The frost-free period is 60 to 125 days.

These soils are used for range, game range, and recreation. Grazing management is necessary for an adequate cover of plants.

#### CAPABILITY UNIT VIIe-1 DRYLAND

This unit consists of deep soils in river valleys, on fans, and in steep mountain valleys. These soils range from clay to gravelly and stony loam.

Permeability is very slow to moderate, and available water capacity is low to high. Runoff is slow to rapid, and the hazard of erosion is slight to severe. The frost-free period is 60 to 125 days.

These soils are used for range. Some areas are used for forest land. Grazing management is necessary for adequate cover of plants.

#### CAPABILITY UNIT VIIIe-1 DRYLAND

This unit consists of areas of Shale outcrop and Rock outcrop in the highlands and sand and gravel bars of Riverwash in river valleys. These land types are barren or nearly barren. Shale outcrop and Rock outcrop are steep and very steep and are on narrow ridges and along rims of deep valleys. Riverwash is flooded annually and is subject to constant change in size and shape.

These land types are not suitable for grazing. Migratory waterfowl use Riverwash as resting areas. Shale



outcrop produces a high volume of runoff and silt during summer rain. Shale outcrop and Rock outcrop provide wildlife habitat and some recreation.

### Predicted Yields of Irrigated Crops

In table 2 the predicted yields per acre of the principal irrigated crops grown in the Area are listed. The yield figures are averages of yields over long periods under an improved level of management. Information was obtained from individual farmers, the Huntley Experiment Station, and farm field trails. The management for each crop is described in the following paragraphs. Fertilizer rates are expressed in actual pounds of nitrogen (N) and phosphoric acid ( $P_2O_5$ ).

Most management recommendations in this section include references to the use of herbicidal sprays. Some states have restrictions on the use of certain pesticides, so check state and local regulations before such sprays are used. Because registrations of pesticides are under review by the Federal Environmental Protection Agency, consult your county extension agent or State Extension specialist to be sure the intended use is still registered. Follow all instructions and precautions listed on the container, and ask your county agent for advice when you plan to use pesticides.

Improved management for spring wheat consists of applying 80 pounds of nitrogen and 70 pounds phosphorus per acre if banded or 140 pounds if broadcast at seeding time; seeding as early as possible; spraying for weed control before the grain is in the boot stage; and irrigating uniformly by border dikes.

Improved management for barley consists of applying 80 pounds of nitrogen and 70 pounds of phosphorus per acre if banded or 140 pounds if broadcast at seeding time; seeding at the earliest possible date; irrigating uniformly by border dikes; spraying to control weeds before grain is in the boot stage; and timing the last irrigation to prevent lodging.

Improved management for oats consists of applying 80 pounds of nitrogen and 70 pounds of phosphorus per acre if banded or 140 pounds if broadcast at seeding time; irrigating uniformly by border dikes; and spraying to control weeds before the grain is in the boot stage.

Improved management for grain corn consists of plowing down 20 tons of barnyard manure per acre; preparing a firm seedbed; applying weed control spray at planting time; applying 50 pounds of nitrogen and 60 pounds of phosphorus per acre; planting 85- to 95-day maturing varieties at the earliest date possible; seeding about 30,000 plants per acre; controlling weeds by spraying until the canopy develops; side dressing with 50 pounds of nitrogen before the tasseling stage; irrigating at maturity; and harvesting at minimum moisture content late in October.

Improved management for silage corn consists of plowing down 20 tons of barnyard manure per acre; preparing a firm seedbed; applying weed control spray at planting time; applying 100 pounds of nitrogen and 60 pounds of phosphorus per acre; planting 90- to 100-day maturing varieties at the earliest date possible; seeding about 30,000 plants per acre; controlling weeds by spraying until the canopy develops; irrigat-

ing between tasseling and silking stages; and harvesting at the dent stage or immediately after the first killing frost.

Improved management for sugar beets consists of applying 100 pounds of nitrogen, 125 pounds of phosphorus, and 10 to 15 tons of barnyard manure per acre; plowing in fall; preparing the seedbed by harrowing, floating, or packing; seeding no later than April 15 and as early as possible after the last killing frost; and irrigating early to insure that seedlings have ample moisture.

Improved management for dry beans consists of planting in strict rotation and never after a sod crop; preparing a firm, smooth seedbed; applying weed control spray at time of planting; applying 40 pounds of nitrogen, 80 pounds of phosphorus, and 15 tons of barnyard manure per acre; planting after the last killing frost; preventing sunscald by timing of irrigation in the latter part of the growing season and controlling mold on the silty clay loam, clay loam, and clay soils; and harvesting in time to prevent shattering.

Improved management for alfalfa hay consists of plowing down 120 pounds of phosphorus per acre; seeding without a nurse crop; seeding into weed-free grain stubble between August 15 and 31; irrigating uniformly in border dikes; controlling alfalfa weevils; cutting no more than 3 times a year; topdressing with 100 pounds of phosphorus per acre each year; and replanting every 4 or 5 years.

Improved management for irrigated pasture consists of good seedbed preparation; timely planting; weed control; fertilization according to need dictated from soil tests; exercising water management practices in accordance with irrigation design and plant needs; and proper rotation grazing practices.

### Predicted Yields of Dryland Crops

In table 2 the predicted yields per acre of dryfarmed winter wheat, barley, oats, hay, and pasture are listed. The yields are based on information provided mostly by farmers and by experiments on test plots at the Huntley Experiment Station.

Improved management for winter wheat consists of destroying volunteer wheat plants by a fall fallow operation; using stubble mulch tillage; beginning spring fallow operations late in April or early in May for weed control; spraying for weed control; planting when the soil temperature is less than 50° F; applying 5 to 7 pounds of nitrogen and 25 pounds of phosphorus per acre at seeding; topdressing with 40 to 45 pounds of nitrogen in spring; and spraying for weeds before the grain is in the boot stage.

Improved management for barley consists of using a crop-fallow system; seeding at the earliest date possible; controlling weeds by spraying during fallow and in the planted grain; and applying 25 pounds of nitrogen and 40 pounds of phosphorus if banded or 80 pounds if broadcast per acre at seeding.

Improved management for oats consists of using a crop-fallow system; seeding at the earliest date possible; controlling weeds by spraying during fallow and in the planted grain; and applying 25 pounds of



TABLE 2.—*Predicted average yields per acre of principal crops*

[Absence of a yield figure indicates that the soil is not suitable for the crop or that the crop is not generally grown on the soil. Only soils suitable for irrigated crops are listed in this table]

Soil	Winter wheat (Dry-land)	Spring wheat (Irrigated)	Barley		Oats		Corn for—		Sugar beets (Irrigated)	Dry beans (Irrigated)	Alfalfa hay		Tame hay (Dry-land)	Pasture	
			(Dry-land)	(Irrigated)	(Dry-land)	(Irrigated)	Grain (Irrigated)	Silage (Irrigated)			(Dry-land)	(Irrigated)		(Dry-land)	(Irrigated)
	Bu	Bu	Bu	Bu	Bu	Bu	Bu	Tons	Tons	Cwt	Tons	Tons	Tons	AUM <sup>1</sup>	AUM
Absarokee silty clay loam, gently undulating	35		55		73						1.5		1.2	1.2	
Absarokee silty clay loam, undulating	35		55								1.3		1.0	1.2	
Absarokee silty clay loam, rolling	24		39								1.1		.9	1.2	
Absarokee-Armington association, gently sloping	35		54								1.3		1.0	1.1	
Adel-Mayflower association, sloping														1.5	
Alice fine sandy loam, 4 to 15 percent slopes	23		35								1.0		.8	.9	
Allentine clay, 0 to 2 percent slopes		30		40		45		14	15			4.0	.7	.8	9
Allentine clay, 2 to 4 percent slopes		25		33		38						3.5	.7	.8	
Allentine-Bone complex, 0 to 1 percent slopes		26		38		43		12				3.5	.6	.8	8
Alluvial land, wet														2.5	
Amherst loam, undulating	24		36								1.0		.8	1.2	
Amherst loam, rolling	22		34										.8	1.0	
Armington silty clay loam													1.0	1.3	
Armington complex, rolling														1.0	
Arnegard loam, 8 to 15 percent slopes	24		35								1.2		.9	1.2	
Arnegard silt loam, 2 to 4 percent slopes	32	55	48	65	58	80		22			1.3	5.0	1.1	1.3	11
Arnegard silt loam, 4 to 8 percent slopes	37		55								1.3		1.0	1.3	
Ascalon sandy loam, 4 to 8 percent slopes	33		49								1.3		1.0	1.1	
Babb silt loam, rolling														1.4	
Beauvais silty clay loam, gently undulating	35	55	55	70	64			22			1.5	5.0	1.2	1.2	11
Beauvais silty clay loam, undulating	34	46	53	66							1.3	4.5	1.0	1.2	8
Beauvais silty clay loam, rolling	26	35	39	53							1.2	3.5	.9	.9	7
Beauvais-Gilt Edge silty clay loams, gently undulating	36	50	52	67				21			1.2	5.0	.9	.9	9
Belfield silt loam, 0 to 1 percent slopes	36	48	55	69	65			19			1.3	5.0	1.1	1.2	9
Belfield silt loam, gently undulating	38	46	50	67	68			19			1.3	5.0	1.1	1.2	10
Belfield silt loam, undulating	35	48	48	60							1.3	4.5	1.1	1.1	8
Belfield-Adger complex, 0 to 1 percent slopes	34		58		65						1.4		1.2	1.1	
Belfield-Adger complex, gently undulating	33		56		60						1.3		1.0	1.0	
Belfield-Adger complex, undulating	31		46								1.2		1.0	.9	
Bew silty clay loam, 0 to 1 percent slopes	23	45	33	55	45	70	90	18	16		1.0	5.0	.8	.9	10
Bew silty clay loam, gently undulating	23	44	33	52	50	69					.9	4.5	.7	.9	8
Bitton gravelly loam, 2 to 8 percent slopes	13		20										.4	.6	7
Cherry silty clay loam, 2 to 8 percent slopes	33	47	49	65	58	80					1.3	5.0	1.0	1.2	9
Chugter loam, 2 to 8 percent slopes	22	48	33	58	51						.9	4.5	.6	.8	7
Chugter complex, 2 to 15 percent slopes	16		24								.8		.6	.8	7
Colby silt loam, 4 to 8 percent slopes	23	50	38	66	55	85					1.1	4.5	.9	1.0	9
Colby silt loam, 8 to 15 percent slopes	14	35	22	50		60					1.0	3.5	.8	.9	7
Colby silty clay loam, 1 to 4 percent slopes	30	52	44	68		90	115	24		24	1.3	5.0	1.0	.9	9
Colby silty clay loam, 4 to 8 percent slopes	24	45	39	61		82					1.1	4.5	.8	.9	8
Colby silty clay loam, 8 to 15 percent slopes	16	34	27	48		55					1.0	3.5	.7	.7	7
Colby-Beauvais silt loams, undulating	23	49	39	62		84					1.1	4.5	.9	.8	9
Colby-Beauvais silt loams, rolling	15	30	24	42		50					1.0	3.5	.8	.8	7
Colby-Clapper silt loams, rolling	13		21								1.0			.8	



TABLE 2.—Predicted average yields per acre of principal crops—Continued

Soil	Winter wheat (Dry- land)	Spring wheat (Irri- gated)	Barley		Oats		Corn for—		Sugar beets (Irri- gated)	Dry beans (Irri- gated)	Alfalfa hay		Tame hay (Dry- land)	Pasture	
			(Dry- land)	(Irri- gated)	(Dry- land)	(Irri- gated)	Grain (Irri- gated)	Silage (Irri- gated)			(Dry- land)	(Irri- gated)		(Dry- land)	(Irri- gated)
	Bu	Bu	Bu	Bu	Bu	Bu	Bu	Tons	Tons	Cwt	Tons	Tons	Tons	AUM <sup>1</sup>	AUM
Colby-Keiser silty clay loams, 4 to 8 percent slopes	25	46	40	65		86					1.1	4.5	0.8	0.8	8
Colby-Midway complex, 8 to 15 percent slopes											1.0			.6	
Colby association, rolling	15		23								1.0			.6	
Cushman loam, undulating	20		33								.9			.9	
Danvers silty clay loam, 0 to 1 percent slopes	45	55	65	70	79	90		20			1.5	5.0	1.2	1.2	11
Danvers silty clay loam, gently undulating	40	50	60	65	72	80					1.4	5.0	1.1	1.2	10
Danvers silty clay loam, undulating	37	45	56	66							1.3	4.5	1.0	1.2	11
Danvers cobbly silty clay loam, 1 to 4 percent slopes	35		56		66						1.4		.9	1.1	
Danvers-Judith silty clay loams, gently undulating	38		58		68						1.4		1.1	1.0	
Danvers-Judith silty clay loams, undulating	34		48								1.3		1.0	1.0	
Danvers-Judith silty clay loams, hilly	21		32								1.1			1.0	
Dast sandy loam, rolling											1.1			.9	
Dast-Parshall sandy loams, rolling	21		33								1.1			1.0	
Doney loam, rolling	21		33											.8	
Doney-Reeder loams, rolling	22		35								1.1			1.0	
Eltzac clay, undulating	30		44											1.0	
Eltzac clay, rolling														.9	
Farnuf loam, 0 to 2 percent slopes	42	55	60	69		90		21			1.5	5.0	1.2	1.2	12
Farnuf loam, 2 to 4 percent slopes	41	57	58	69	73	85		23			1.4	5.0	1.1	1.2	12
Farnuf loam, 4 to 8 percent slopes	37	47	50	55		75					1.3	4.5	1.1	1.2	10
Farnuf-Doney association, sloping	21		36								1.1		1.0	1.0	9
Fergus silt loam, 2 to 4 percent slopes	37		55								1.3			1.2	
Fergus silt loam, 4 to 8 percent slopes	30		44											1.4	
Fergus silt loam, 8 to 15 percent slopes														1.3	
Fort Collins loam, 0 to 2 percent slopes	30	57	49	74	60	95	135	25	22	28	1.1	5.5	.9	.9	12
Fort Collins loam, 2 to 4 percent slopes	25	57	39	74	51	95	120	23	21	25	.9	5.0	.9	.9	11
Fort Collins loam, 4 to 8 percent slopes	24	51	37	58		85					.9	4.5	.8	.8	10
Fort Collins loam, channeled, 4 to 8 percent slopes											.9			.7	
Frazer silty clay loam	34	43	50	59				19			1.4	5.0	1.1	1.2	12
Frazer silty clay loam, saline	24		34								1.2		.8	1.0	
Frazer silty clay	32	42	49	58				19			1.3	4.0	.9	1.3	10
Gilt Edge silty clay loam, 0 to 2 percent slopes	14	33	20	41							.5	3.0	.8	.9	9
Gilt Edge silty clay loam, 2 to 4 percent slopes	13	35	20	41							.5	3.0	.8	.9	9
Gilt Edge-Bone complex, 0 to 1 percent slopes	13	30	20	38							.4			.9	9
Gilt Edge-Bone complex, 1 to 4 percent slopes	12	30	20	38							.4			.8	9
Glenberg fine sandy loam, 0 to 2 percent slopes	17	52	26	66		80	100	21	16	19	1.0	4.5	.6	1.1	10
Glenberg fine sandy loam, 2 to 4 percent slopes	15	50	21	66				19	14		.9	4.5	.6	.9	10
Glenberg fine sandy loam, 4 to 8 percent slopes	15	45	21	55							.9	4.0	.6	.9	10
Glenberg loam, 0 to 2 percent slopes	16	45	23	60		80	100	22	18	21	.9	4.0	.7	.9	12
Grail clay loam, 0 to 2 percent slopes	40	45	58	64		70		17			1.5	4.5	1.2	1.3	12
Grail clay loam, 2 to 8 percent slopes	35	44	49	57		75					1.3	4.5	1.2	1.3	11
Grail clay loam, 8 to 15 percent slopes	22		38								1.1			1.2	



TABLE 2.—Predicted average yields per acre of principal crops—Continued

Soil	Winter wheat (Dry- land)	Spring wheat (Irri- gated)	Barley		Oats		Corn for—		Sugar beets (Irri- gated)	Dry beans (Irri- gated)	Alfalfa hay		Tame hay (Dry- land)	Pasture	
			(Dry- land)	(Irri- gated)	(Dry- land)	(Irri- gated)	Grain (Irri- gated)	Silage (Irri- gated)			(Dry- land)	(Irri- gated)		(Dry- land)	(Irri- gated)
	Bu	Bu	Bu	Bu	Bu	Bu	Bu	Tons	Tons	Cwt	Tons	Tons	Tons	AUM <sup>1</sup>	AUM
Grail silty clay, 0 to 2 percent slopes	30	37	44	50	60						1.3	4.5	0.9	1.1	10
Harvey loam, gently undulating	19	50	31	71		88		23		23	1.1	5.5	.9	.8	12
Harvey loam, undulating	19	47	31	66		85					1.1	4.5	.8	.8	11
Harvey loam, rolling	15		22								1.0		.7	.8	
Harvey gravelly loam, undulating	22		33								1.1			.7	
Harvey complex, undulating											1.1			.7	
Haverson loam, 0 to 2 percent slopes	30	57	48	70		90	135	25	22	26	.9	5.5	.9	.9	12
Haverson loam, 2 to 4 percent slopes	24	52	35	68		87	120	23	18	24	.9	5.0	.9	.9	12
Haverson loam, saline	20		30								1.0			2.5	
Haverson silty clay loam	31	57	49	79		95	135	25	21	26	.9	5.5	.9	.9	12
Haverson silty clay		48		72		85	95	20	16		.9	4.5	.8	.8	11
Haverson silty clay, thick surface		50		70		80	100	21	17		1.1	5.0	.9	.9	12
Haverson-Hysham silty clay loams	20		32								.9		.6	.7	
Haverson and Glenberg soils											1.1			.8	
Haverson soils, saline	13		22								.5		1.0	1.5	
Heldt silty clay loam, 0 to 2 percent slopes	23	52	35	74	45	93	95	23	20		1.0	5.0	.9	.9	12
Heldt silty clay loam, 2 to 4 percent slopes	23	52	35	74	50	93	100	23	20		.9	5.0	.8	.9	11
Heldt silty clay loam, 4 to 8 percent slopes	21	47	33	66		80					.9	4.5	.8	.9	10
Heldt silty clay loam, 8 to 15 percent slopes	15		23								.8		.7	.9	
Heldt silty clay, 0 to 2 percent slopes		45		55				18	17			5.0		.9	12
Heldt-Hysham silty clay loams, 0 to 2 percent slopes	20		30								.9			.7	
Heldt-Hysham silty clay loams, 2 to 4 percent slopes	19		31								.9			.8	
Hesper silty clay loam, 0 to 1 percent slopes	33	50	50	70		90	135	24	20	24	1.0	5.5	1.1	.9	12
Hesper silty clay loam, 1 to 4 percent slopes	25	47	39	65		85	120	23	19		.9	5.0	.9	.9	11
Hesper silty clay loam, 4 to 8 percent slopes	23	45	37	60		70					.9	4.0	.8	.9	10
Hydro loam, 0 to 8 percent slopes	27		40								.9			.9	
Hydro silt loam, 0 to 2 percent slopes	30	50	46	72		83		20			1.0	4.5	.8	.8	10
Hydro silt loam, 2 to 4 percent slopes	36	44	54	58		68		18			.9	1.1	.8	.8	10
Hydro silt loam, 4 to 8 percent slopes	30		44											.9	
Hydro silty clay loam, 0 to 2 percent slopes	21	50	30	72		80					1.0	4.5	.8	.7	10
Hydro silty clay loam, 2 to 4 percent slopes	25	50	35	70		77					1.0	4.5	.8	.7	10
Hydro-Allentine complex, 1 to 4 percent slopes	13		21										.7	.7	
Hydro-Allentine complex, 4 to 8 percent slopes	12		19										.7	.7	
Hydro-Gilt Edge complex, 0 to 1 percent slopes	23		34											.9	
Judith clay loam, 0 to 2 percent slopes	36	48	54	62				18			1.3	4.5	1.0	1.2	11
Judith clay loam, 2 to 4 percent slopes	39	46	59	59							1.2	4.5	1.0	1.2	10
Judith clay loam, 4 to 8 percent slopes	36	29	55	45							1.2	3.5	1.0	1.2	10
Judith-Windham complex, 4 to 8 percent slopes	31		46								1.1		.9		
Judith-Windham complex, 8 to 15 percent slopes	21		32								.9		.8		
Keiser silty clay loam, 0 to 2 percent slopes	27	56	42	70		85	120	22	18	23	.9	5.5	.7	.9	12
Keiser silty clay loam, 2 to 4 percent slopes	23	47	35	65		80			17		.9	5.0	.7	.9	10
Keiser silty clay loam, 4 to 8 percent slopes	20		31								.9	4.5	.6	.9	10



TABLE 2.—Predicted average yields per acre of principal crops—Continued

Soil	Winter wheat (Dry- land)	Spring wheat (Irri- gated)	Barley		Oats		Corn for—		Sugar beets (Irri- gated)	Dry beans (Irri- gated)	Alfalfa hay		Tame hay (Dry- land)	Pasture	
			(Dry- land)	(Irri- gated)	(Dry- land)	(Irri- gated)	Grain (Irri- gated)	Silage (Irri- gated)			(Dry- land)	(Irri- gated)		(Dry- land)	(Irri- gated)
	Bu	Bu	Bu	Bu	Bu	Bu	Bu	Tons	Tons	Cut	Tons	Tons	Tons	AUM <sup>1</sup>	AUM
Keiser-Colby complex, gently undulating	20		32								1.0		0.8	0.8	
Kim loam, 4 to 15 percent slopes											.8			.8	
Korchea loam, 0 to 2 percent slopes	46	57	60	67				21	21		1.3	5.0	1.2	1.2	12
Korchea loam, 2 to 4 percent slopes	42	57	60	67				24	20		1.3	4.5	1.1	1.2	12
Korchea silt loam, 0 to 2 percent slopes	41	52	57	62				20			1.5	4.5	1.1	1.2	12
Korchea silty clay loam, 0 to 2 percent slopes	45	48	55	62							1.5	4.5	1.2	1.2	12
Korchea silty clay loam, 2 to 4 percent slopes	42	45	62	56							1.4	4.5	1.1	1.1	11
Korchea and Frazer soils, water table														1.2	
Kyle silty clay, 0 to 2 percent slopes	22	40	34	60	43	77	90	19	15		1.1	4.0	.7	.9	12
Kyle silty clay, 2 to 4 percent slopes	20	40	34	56	43	75					1.1	4.0	.7	.9	12
Kyle silty clay, 4 to 8 percent slopes	19		31		43						1.1		.6	.9	
Kyle gravelly silty clay, 8 to 15 percent slopes	15		25								.9		.7	.8	
Kyle clay, saline	13		20								.6			.9	
La Fonda loam, 2 to 4 percent slopes	20		32								1.1		.8	.8	
Lavina-Travessilla loams, undulating	14		20											.9	
Lennep loam, 2 to 4 percent slopes	35		54								1.1			1.3	
Lennep loam, 4 to 8 percent slopes	25		35								1.1			1.3	
Lennep-Adger complex, gently undulating	31		46								1.1			1.0	
Lennep-Adger complex, undulating	22		37											1.0	
Lismas-Vananda clays, undulating	15		26											.8	
Lohmiller silty clay loam, 0 to 2 percent slopes	22	54	35	70	55	85	100	22	20	21	1.1	5.0	.8	.9	12
Lohmiller silty clay loam, 2 to 4 percent slopes	20	52	33	62	50	77		21	18	20	.9	5.0	.8	.9	12
Lohmiller silty clay loam, 4 to 8 percent slopes	20	47	33	57							.9	4.5	.7	.9	11
Lohmiller silty clay loam, 8 to 15 percent slopes	16		27								.8			.8	
Lohmiller silty clay, saline, 0 to 2 percent slopes	13		23											.6	
Lohmiller silty clay, saline, 2 to 4 percent slopes	12		22											.6	
Lohmiller-Midway silty clay loams, undulating											.8			.8	
Macar loam, 4 to 8 percent slopes	25	46	38	58							1.1	4.0	1.1	1.0	10
Marias clay, 0 to 2 percent slopes	36	44	50	55		60		15			1.2	4.0	1.1	.9	10
Marias clay, 2 to 4 percent slopes	33	43	48	49							1.2	4.0	1.0	.9	10
Marias clay, 4 to 8 percent slopes	25	30	39	41							.9	3.0	1.0	.9	10
Marias clay, 8 to 15 percent slopes	24		39								.9			.7	
Maschetah complex, rolling	23		33								1.0		1.1	1.1	
McKenzie clay	28		40											1.3	
McRae loam, 0 to 1 percent slopes	28	57	43	77	60	85	135	25	21	27	1.0	5.5	.8	.9	12
McRae loam, 1 to 4 percent slopes	24	52	39	65	52	78	120	23	19	24	1.1	5.0	.8	.9	12
McRae loam, 4 to 8 percent slopes	22	49	37	62		72					1.1	4.5	.7	.8	11
McRae silty clay loam, 0 to 1 percent slopes	31	55	45	79	60	95	135	25	22	26	1.1	5.5		.9	12
Midway silty clay loam, undulating	14		21											.9	12
Midway-Thurlow association, rolling														.9	
Morton silt loam, undulating	39		58								1.3		1.3	1.3	
Nelson fine sandy loam, undulating	15		22											.9	
Nelson-Alice fine sandy loams, rolling													.9	.9	
Nelson-Glenberg sandy loams, undulating														.8	
Neville loam, rolling	19	31									1.0			.7	

TABLE 2.—Predicted average yields per acre of principal crops—Continued

Soil	Winter wheat (Dry- land)	Spring wheat (Irri- gated)	Barley		Oats		Corn for—		Sugar beets (Irri- gated)	Dry beans (Irri- gated)	Alfalfa hay		Tame hay (Dry- land)	Pasture	
			(Dry- land)	(Irri- gated)	(Dry- land)	(Irri- gated)	Grain (Irri- gated)	Silage (Irri- gated)			(Dry- land)	(Irri- gated)		(Dry- land)	(Irri- gated)
	Bu	Bu	Bu	Bu	Bu	Bu	Bu	Tons	Tons	Cwt	Tons	Tons	Tons	AUM <sup>1</sup>	AUM
Nunn silty clay loam, 0 to 1 percent slopes	29	54	43	74	57	90	100	23	20		1.2	5.0	1.0	1.2	12
Nunn silty clay loam, 1 to 4 percent slopes	29	54	43	74	51	85	115	22	18		1.3	5.0	1.0	1.2	12
Nunn silty clay loam, 4 to 8 percent slopes	29	50	43	65	60	80					1.1	4.5	.8	1.1	10
Nunn silty clay loam, 8 to 15 percent slopes	17		27								1.0		.8	1.0	
Nunn-Midway silty clay loams, 4 to 15 percent slopes													.9	.7	
Olney fine sandy loam, 4 to 12 percent slopes	22		35								1.0		.8	.9	
Parshall fine sandy loam, 4 to 8 percent slopes	35		54								1.3		1.1	1.2	
Peritsa silt loam, undulating	32		48								1.1		1.1	1.2	
Peritsa-Abac loams, rolling														1.0	
Peritsa complex, rolling														1.0	
Pierre clay, undulating	17		27		40									.9	
Pierre-Kyle clays, gently undulating	15		24		28									.9	
Pultney-Neville association, undulating	19	31									1.0			.7	
Raynesford loam, undulating														1.3	
Reeder loam, gently undulating	39		59								1.3		1.2	1.1	
Reeder loam, undulating	32		47								1.2		1.0	1.1	
Reeder-Regent complex, rolling	22		36								1.1		1.2	1.2	
Reeder-Darret association, undulating											1.4			1.3	
Reeder-Darret association, rolling											1.1			1.3	
Regent silty clay loam, gently undulating	35		54								1.3		1.0	1.2	
Regent silty clay loam, undulating	34		52								1.2		1.0	1.1	
Regent silty clay loam, rolling	23		34								1.0		.8	1.1	
Renohill silty clay loam, undulating	22		34								.9		.8	.9	
Richfield silty clay loam, 0 to 2 percent slopes	33	55	48	79		95	120	25	20	26	1.1	5.5	.9	1.1	12
Richfield silty clay loam, gently undulating	21	52	33	72		90	100	23	19		1.0	5.5	.9	1.0	11
Richfield silty clay loam, undulating	20	45	33								1.0	5.0	.8	.9	10
Richfield-Beauvais silty clay loams, gently undulating	23	52	36	70		90					1.1	5.0	.9	1.0	11
Richfield-Beauvais silty clay loams, undulating	20	44	34								1.1	4.5	.8	.9	11
Rottulee silt loam, gently undulating	34		51								1.2		.9	1.1	
Rottulee silt loam, undulating	32		47								1.0		.8	1.0	
Rottulee silt loam, rolling													.8	1.0	
Savage silty clay loam, 0 to 2 percent slopes	39	57	58	67		85		22			1.3	5.0	1.1	1.2	12
Savage silty clay loam, 2 to 4 percent slopes	39	50	58	65		77		20			1.3	5.0	1.0	1.2	12
Savage silty clay loam, 4 to 8 percent slopes	34		50								1.3	4.5	1.0	1.1	10
Savage silty clay loam, undulating	31		45								1.3		1.0	1.1	
Savage silty clay loam, rolling	21		35								1.0		1.0	1.1	
Savage-Wayden silty clay loams, 4 to 15 percent slopes											.9		1.1	1.2	
Searing loam, undulating	32		48								1.1		.9	.9	
Searing-Ringling complex, rolling														1.0	
Shaak clay loam, 4 to 8 percent slopes	31	37	46	53		64					1.2	3.5	1.0	1.1	10
Shaak silty clay loam, 0 to 2 percent slopes	37	37	52	53							1.2	4.0	1.1	1.2	12
Shaak silty clay loam, gently undulating	43	39	49	52							1.3	4.5	1.0	1.1	10
Shaak silty clay loam, undulating	37	35	45	50							1.2	3.5	1.0	1.0	9
Shaak silty clay loam, rolling	22		35								1.0		.8	1.0	9



TABLE 2.—Predicted average yields per acre of principal crops—Continued

Soil	Winter wheat (Dry-land)	Spring wheat (Irrigated)	Barley		Oats		Corn for—		Sugar beets (Irrigated)	Dry beans (Irrigated)	Alfalfa hay		Tame hay (Dry-land)	Pasture	
			(Dry-land)	(Irrigated)	(Dry-land)	(Irrigated)	Grain (Irrigated)	Silage (Irrigated)			(Dry-land)	(Irrigated)		(Dry-land)	(Irrigated)
	Bu	Bu	Bu	Bu	Bu	Bu	Bu	Tons	Tons	Cwt	Tons	Tons	Tons	AUM <sup>1</sup>	AUM
Shaak complex, 4 to 15 percent slopes													1.1	1.0	
Shonkin clay loam	36		50								1.1		1.4	1.3	
Sofia silty clay, 0 to 2 percent slopes	34	45	52	62				16	19		1.3	5.0	1.2	1.2	11
Sofia silty clay, gently undulating	32	45	50	60		77					1.2	4.5	1.2	1.1	10
Spearman loam, undulating	20		33										.7	.9	
Spearman-Wibaux complex, rolling	15		21										.6	.7	
Stormitt complex, 0 to 4 percent slopes													.7	.8	
Stormitt complex, 4 to 15 percent slopes													.6	.8	
Tarrete silty clay loam, 8 to 15 percent slopes														1.5	
Terry fine sandy loam, undulating	15		21											.9	
Teton loam, 8 to 25 percent slopes														1.4	
Thedalund loam, undulating	30		44										.7	.7	
Thedalund-Cushman loams, undulating	20		37										.8	.8	
Thedalund-Fort Collins complex, rolling													.7	.7	
Thedalund-McRae loams, dissected														.8	
Thedalund-Midway complex, rolling														.7	
Thedalund-Nelson complex, rolling														.8	
Thurlow silty clay loam, 0 to 1 percent slopes	29	57	42	67	55	95	135	24	21	28	.9	5.5	.9	.9	11
Thurlow silty clay loam, 1 to 4 percent slopes	22	57	34	67	50	90	120	22	20	24	.9	5.5	.8	.9	10
Thurlow silty clay loam, 4 to 8 percent slopes	20	51	33	62	50	85					.9	4.5	.7	.9	9
Thurlow-Midway silty clay loams, 4 to 15 percent slopes											.8		.8	.7	
Toluca-Harvey complex, undulating	20		33		50						.9		.8	.9	
Twin Creek loam, 2 to 4 percent slopes	40	47	60	57							1.3	4.5	1.0	1.3	9
Twin Creek loam, 4 to 8 percent slopes	32		48								1.3		1.1	1.3	11
Twin Creek loam, 8 to 15 percent slopes	25		38								1.1		.9	1.1	9
Twin Creek-Korchea complex, 2 to 8 percent slopes	36		59								1.3		1.0	1.2	
Vananda clay, 0 to 1 percent slopes		25		35				10	11					.3	6
Vebar fine sandy loam, undulating	30		46										.9	1.2	
Vebar fine sandy loam, rolling	23		33								1.1			1.2	
Vebar complex, rolling														1.1	
Wages loam, 0 to 2 percent slopes	30	55	49	79	60	95	135	24	22	28	1.1	5.5	1.0	1.2	12
Wages loam, 2 to 4 percent slopes	24	50	37	72	50	90	125	21	20	24	1.1	5.5	.9	1.1	11
Wages loam, 4 to 8 percent slopes	21	45	34	62							1.0	4.5	.9	1.1	10
Wayden-Savage silty clay loams, rolling											.9		.8	.9	
Xavier silty clay loam, gently undulating	40	53	52	59		85					1.3	5.0	1.0	1.2	10
Xavier silty clay loam, undulating	31	40	46	52		73					1.1	4.5	.9	1.1	9
Xavier silty clay loam, rolling	25		36										.9	1.0	
Xavier-Shaak complex, undulating	32		47								1.2		1.0	1.1	
Xavier-Shaak complex, rolling	24		36								1.1		.8	1.0	

<sup>1</sup>AUM = Animal-unit-months. An animal-unit-month expresses the carrying capacity of pasture. It is the number of animal units, or 1,000 pounds of live weight, that can be grazed on an area of pasture for 30 days.

nitrogen and 40 pounds of phosphorus if banded or 80 pounds if broadcast per acre at seeding.

Improved management for alfalfa hay consists of seeding without a nurse crop; seeding into weed-free grain stubble between August 15 and 31; controlling alfalfa weevils; cutting once each year; controlling weeds; and reseeding when needed.

Improved management for hay and pasture consists of seeding into a firm weed-free seedbed, preferably in fall; controlling weeds by spraying and slipping; and topdressing grass plantings with 50 pounds of nitrogen and 50 pounds of phosphorus per acre each year.

The amount of water available in the soil during the growing season is the most important factor that affects dryfarmed crops. Rainfall from April to June is the most important for crop growth. Rain during the summer fallow period provides moisture for crops the next year. In fall, rain helps germinate new seedlings and provides moisture for growth early in spring.

### Use of the Soils for Range<sup>2</sup>

In the Big Horn County Area, rangeland makes up 2,501,257 acres, or about 78 percent of the total acreage. It is the basis for the livestock enterprises that form the largest income-producing industry in the Area. It also provides habitat for most of the wildlife, protection for the vast acreage of watershed, and recreation, and it has esthetic value.

The north half of the Area receives 11 to 14 inches of precipitation annually, while most of the southern part averages 15 to 19 inches annually. Some of the mountainous areas receive 20 to 24 inches.

#### Range sites and condition classes

There are many differences in the soils and climate of the Big Horn County Area. For this reason there are several different kinds of rangeland, called range sites.

A given range site has the ability to produce different kinds or amounts, or both, of climax vegetation than any other range site. Over the centuries, nature has developed a combination of plants that is best suited to a particular climate and soil. This group of plants is called the potential, or climax, plant community for the site. The climax plant community for a site varies slightly from year to year, but the kinds and percentages of plants remain about the same in undisturbed areas.

The original combination of plants fitted the soil and climate of the site so perfectly that other kinds of plants could not move in unless the area was disturbed. So consistent is the relation among plants, climate, and soils that the climax plant community can be predicted even on severely disturbed sites if the soil is identified. If good management is practiced, near-climax plant communities may be maintained, or, in the case of disturbed vegetation, the climax community may be gradually re-established unless the soils have been seriously eroded.

<sup>2</sup> By STERLE E. DALE, range conservationist, Soil Conservation Service.

Plants are categorized as decreasers, increasers, or invaders according to their response to grazing pressures.

*Decreasers* are dominant climax plants that tend to decrease in relative amount under close grazing. They are generally the most productive and the most palatable to grazing animals.

*Increasers* are plants in the climax vegetation that increase in relative amount as the more desirable decreaser plants are reduced by close grazing. They are generally less palatable and are woody, spiny, or so short that they escape close grazing.

*Range condition* is an expression of the present kind and amount of vegetation in relation to the climax plant community for that site. The more nearly the present kinds and amounts of plants are like the climax plant community, the higher the range condition.

A range is in *excellent* condition if 76 to 100 percent of the vegetation is of the same kind as that in the climax stand. It is in *good* condition if the percentage is 51 to 75. It is in *fair* condition if the percentage is 26 to 50 and in *poor* condition if the percentage is less than 25.

The present range condition provides an index to changes that have taken place in the plant community. More important, however, range condition is a basis for predicting the kinds and amounts of changes in the present plant community that can be expected from management and treatment measures. Thus, the range condition rating indicates the nature of the present plant community, and the climax plant cover represents a goal toward which rangeland management may be directed.

Knowledge of the climax plant communities of range sites and the nature of present plant communities in relation to their potential is important in planning and applying conservation on rangeland. Such information is the basis for selecting management objectives, designing grazing systems, managing wildlife, determining potential for recreation, and rating the condition of the watershed.

Any management objective on rangeland must provide for plant cover that adequately protects or improves the soil and water resources and meets the needs of the operator. This usually involves increasing desirable plants and restoring the plant community to near-climax conditions. Sometimes, however, a plant cover somewhat less than climax will better fit specific grazing needs or provide better wildlife habitat while still protecting the soil and water resources.

All range sites respond favorably to proper grazing use and systems of grazing deferment.

#### Descriptions of range sites

In the following pages the range sites of the Area are described, and the climax plants and principal invaders on the site are named. Also shown are estimates of the potential annual yield per acre of air-dry herbage for each site if in excellent condition. The soils in each site can be determined by referring to the "Guide to Mapping Units" at the back of this soil survey.



OVERFLOW SITE, 10- TO 14-INCH  
PRECIPITATION ZONE

This range site is made up of deep, well-drained silty clay loams, loams, and fine sandy loams. It is on low terraces and flood plains that regularly receive more than normal soil moisture because of runoff or stream overflow. This site makes up about 1 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	Percent
Western and thickspike wheatgrass	40
Other tall grasses	15
Green needlegrass	10
Woody plants	10
Needleandthread	5
Little bluestem	5
Slender wheatgrass	5
Perennial forbs	5
Annuals	5

Total annual yield on range in excellent condition is 2,400 pounds air-dry herbage per acre. In less favorable years yield is as little as 800 pounds per acre. About 90 percent of the plants in this site furnish forage for cattle, horses, sheep, deer, and antelope.

Under continuous heavy use green needlegrass, western wheatgrass, and the other climax plants decrease and are replaced by silver sagebrush, Kentucky bluegrass, Canada bluegrass, and annual plants. Range deterioration is often reflected by an increase in silver sagebrush, rosebush, snowberry, and Kentucky and Canada bluegrass.

SALINE LOWLAND SITE, 10- TO 14-INCH  
PRECIPITATION ZONE

This range site is made up of deep, mixed alluvial soils of silty clay loam, loam, silt loam, and clay loam. It is characterized by subirrigated and overflow land where accumulations of salt or alkali, or both, are apparent, and salt-tolerant plants occur over a major part of the area. This site makes up about 0.5 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	Percent
Alkali cordgrass	25
Western wheatgrass	25
Alkali sacaton	15
Saltgrass	10
Alkali grass	10
Sedges	5
Muhly	5
Forbs	5

Total annual yield on range in excellent condition is 1,800 pounds air-dry herbage per acre. In less favorable years yield is as little as 1,400 pounds per acre. About 60 percent of the plants in this site furnish forage for cattle, sheep, deer, and antelope.

Under continuous heavy use the taller decreasers are replaced by annuals of the goosefoot family.

Range recovery is somewhat slow because of the salt content of the soils. This site is unsuitable for mechanical treatment.

SANDS SITE, 10- TO 14-INCH PRECIPITATION  
ZONE

This range site is made up of sand and loamy sand soils that are more than 20 inches deep. The intake

rate favors light rainfall because runoff is low. Soil blowing is a hazard in places where plant cover is destroyed by excessive grazing. This site makes up about 0.5 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	Percent
Prairie sandreed	35
Little bluestem	20
Needleandthread	10
Woody plants	10
Sand bluestem	5
Western wheatgrass	5
Perennial forbs	5
Upland sedges	5
Short grasses	5
Big bluestem	Trace

Total annual yield on range in excellent condition is 1,800 pounds air-dry herbage per acre. In less favorable years yield is as little as 900 pounds per acre. About 90 percent of the plants in this site furnish forage for grazing animals.

Under continuous heavy use prairie sandreed, little bluestem, sand bluestem, and big bluestem decrease in the plant community and are replaced by needleandthread, western wheatgrass, sedges, and large amounts of annual grasses and forbs.

This site is poorly suited to mechanical treatments because soil blowing is a hazard.

SANDY SITE, 10- TO 14-INCH PRECIPITATION  
ZONE

This range site is made up coarse sandy loam to fine sandy loam soils that are more than 20 inches deep. It makes up about 2 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	Percent
Bluebunch wheatgrass	15
Little bluestem	15
Needleandthread	15
Prairie sandreed	15
Western wheatgrass	15
Other tall grasses	10
Sand bluestem	5
Woody plants	5
Sand dropseed	3
Side-oats grama	2
Short grasses	Trace
Green sagewort	Trace

Total annual yield on range in excellent condition is 2,300 pounds air-dry herbage per acre. In less favorable years yield is as little as 800 pounds per acre. About 90 percent of the plants in this site furnish forage for cattle, sheep, deer, and antelope.

Under continuous heavy use the bluestems, needleandthread, prairie sandreed, side-oats grama, and other high-producing grasses decrease in the plant community and are replaced by upland sedges, green sagewort, tumblegrass, fringed sagewort, and annual grasses and forbs.

Range recovery is slow on this site where the climax dominants have been nearly grazed out. Where topography is favorable, most mechanical treatments hasten recovery if enough of the original climax vegetation remains. In other areas a complete seedbed preparation followed by range seeding offers the best opportunity for range improvement. Brush management is advan-

tageous in areas that have an excessive growth of rose-bush, snowberry, or other brushy vegetation.

SILTY SITE, 10- TO 14-INCH PRECIPITATION  
ZONE

This range site is made up of moderately deep and deep soils that have a surface layer of loam, silt loam, or silty clay loam. The infiltration rate is good, and the soils hold most of the usual precipitation. This site makes up about 9 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	Percent
Western wheatgrass	20
Needleandthread	20
Bluebunch wheatgrass	15
Green needlegrass	10
Forbs	10
Little bluestem	5
Plains muhly	5
Blue grama	5
Silver sagebrush	5
Threadleaf sedge	5

Total annual yield on range in excellent condition is about 1,800 pounds air-dry herbage per acre. In less favorable years yield is as little as 600 pounds per acre.

Good management has permitted sizeable areas to remain in excellent condition, and range in poor condition is normally confined to recently abandoned cropland and areas of livestock concentrations. Under continuous heavy use the climax plants in the plant community decrease and are replaced by blue grama, Sandberg bluegrass, threadleaf sedge, brushy plants, and other species that are less palatable to livestock.

This site is suitable for such mechanical treatments as shallow chiseling, range pitting, and furrowing followed by range deferment. Complete seedbed preparation followed by seeding of suited species of native grasses is the quickest treatment for restoration of range in poor condition. Brush management is feasible in many areas that have a heavy growth of big sagebrush.

CLAYEY SITE, 10- TO 14-INCH PRECIPITATION  
ZONE

This range site is made up of moderately deep to deep granular clay loam, silty clay loam, silty clay, sandy clay, and clay soils. It makes up about 10 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	Percent
Western wheatgrass	40
Green needlegrass	15
Forbs	15
Bluebunch wheatgrass	10
Blue grama	5
Plains reedgrass	5
Greasewood	5
Big sagebrush	5

Total annual yield on range in excellent condition is about 1,800 pounds air-dry herbage per acre. In less favorable years yield is as little as 600 pounds per acre.

Under continuous heavy use bluebunch wheatgrass, green needlegrass, western wheatgrass, and prairie clover decrease in the plant community and are replaced by big sagebrush, blue grama, plains reedgrass, and Sandberg bluegrass.

This site is well suited to mechanical treatments if adequate amounts of western wheatgrass and green needlegrass are present. Seeding adapted species results in satisfactory range improvement if it is followed by good management. Brush management is feasible in many areas that have a heavy growth of big sagebrush.

THIN HILLY SITE, 10- TO 14-INCH  
PRECIPITATION ZONE

This range site is made up of loam to silty clay loam soils that have an effective rooting depth of more than 20 inches. Slopes range from 15 to 50 percent. Small eroded areas are common. This site makes up about 18 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	Percent
Western and thickspike wheatgrass	25
Needleandthread	20
Little bluestem	10
Woody plants	10
Prairie sandreed	5
Blue grama	5
Green needlegrass	5
Sedges	5
Perennial forbs	5
Plains muhly	5
Bluebunch wheatgrass	5
Side-oats grama	Trace
Plains reedgrass	Trace
Annual grasses and forbs	Trace

Total annual yield on range in excellent condition is 1,300 pounds air-dry herbage per acre. In less favorable years it is as little as 650 pounds per acre. About 90 percent of the plants in this site furnish forage for cattle, horses, sheep, deer, and antelope.

Under continuous heavy use western wheatgrass, thickspike wheatgrass, prairie sandreed, green needlegrass, and bluebunch wheatgrass decrease in the plant community and are replaced by blue grama, upland sedges, fringed sagewort, and such invaders as curly-cup gumweed, broom snakeweed, and annual forbs and grasses.

This site is not well suited to mechanical treatments because it has steep slopes and erosion is a hazard.

SHALLOW CLAY SITE, 10- TO 14-INCH  
PRECIPITATION ZONE

This range site is made up of soils that have a thin, granular surface layer and a dense, weak blocky to massive subsurface layer that rests abruptly on platy, fractured shale at a depth of less than 20 inches. A few scattered, barren shale areas may occur in this site. This site makes up about 6 percent of the range of the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	Percent
Western wheatgrass	45
Green needlegrass	20
Perennial forbs	10
Little bluestem	5
Prairie sandreed	5
Bluebunch wheatgrass	5
Rocky Mountain juniper	5
Annual grasses and forbs	5
Plains muhly	Trace
Greasewood	Trace
Nuttall saltbush	Trace
Winterfat	Trace



Total annual yield on range in excellent condition is 1,200 pounds air-dry herbage per acre. In less favorable years yield is as little as 600 pounds per acre. About 90 percent of the plants in this site furnish forage for cattle, sheep, horses, deer, and antelope.

Under continuous heavy use western wheatgrass, plains muhly, prairie sandreed, green needlegrass, bluebunch wheatgrass, little bluestem, nuttall saltbush, and greasewood decrease in the plant community and are replaced by curlycup gumweed, broom snakeweed, foxtail barley, sunflower, and numerous other annual grasses and forbs.

This site is not suited to mechanical treatments because the soils are shallow and soil blowing is a hazard. Uniform distribution of grazing is difficult on this site because of the varied terrain and lack of good permanent water development. Stock-water ponds on this site generally become filled with sediment in a few years.

SHALLOW TO GRAVEL SITE, 10- TO 14-INCH  
PRECIPITATION ZONE

This range site is made up of soils that have a thin surface layer of loam or gravelly sandy loam that rests on clean sand and gravel at a depth of 6 to 12 inches. It is on steep, dissected edges of gravel terraces. This site makes up about 1 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	Percent
Needleandthread	25
Western and thickspike wheatgrass	20
Bluebunch wheatgrass	10
Short grasses	10
Perennial forbs	10
Little bluestem	5
Prairie sandreed	5
Sand dropseed	5
Sedges	5
Annuals	5

Total annual yield on range in excellent condition is 1,200 pounds air-dry herbage per acre. In less favorable years yield is as little as 600 pounds per acre. About 95 percent of the plants in this site furnish forage for cattle, horses, sheep, deer, and antelope.

Under continuous heavy use needleandthread, western wheatgrass, thickspike wheatgrass, and bluebunch wheatgrass decrease in the plant community and are replaced by sedges, blue grama, Sandberg bluegrass, red three-awn, hairy goldaster, and annual forbs.

This site is unsuitable for such mechanical treatments as pitting, shallow chiseling, and range seeding.

SHALLOW SITE, 10- TO 14-INCH PRECIPITATION  
ZONE

This range site is made up of loam and sandy loam soils that are 10 to 20 inches deep over hard or soft decomposed granite, siltstone, or sandstone bedrock. Few roots penetrate to a depth of more than 20 inches. This site makes up about 2 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	Percent
Needleandthread	25
Bluebunch wheatgrass	20
Western wheatgrass	20
Blue grama	10

Forbs	10
Green needlegrass	5
Little bluestem	5
Prairie junegrass	5
Big sagebrush	Trace

Total annual yield on range in excellent condition is 1,200 pounds air-dry herbage per acre. In less favorable years yield is as little as 600 pounds per acre. About 90 percent of the plants in this site furnish forage for cattle, horses, sheep, deer, and antelope.

Under continuous heavy use bluebunch wheatgrass, green needlegrass, and little bluestem decrease in the plant community and are replaced in part by shorter grasses, such as blue grama, Sandberg bluegrass, and annuals.

This site is not suitable for mechanical treatments because soil blowing is a hazard. Range seeding is not practical except on abandoned cultivated land where the climax vegetation has been destroyed.

PAN SPOTS SITE, 10- TO 14-INCH  
PRECIPITATION ZONE

This range site is made up of silty, clayey, or sandy soils that are mapped in complex with soils in shallow depressions that have hard clay or other impervious material at or near the surface. The shallow depressions make up 20 to 50 percent of this site. If the site is in good to excellent condition, runoff is not excessive because the soils are gently sloping. This site makes up 1 percent of the range of the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	Percent
Western wheatgrass	35
Green needlegrass	10
Plains reedgrass	10
Blue grama	10
Forbs	10
Needleandthread	5
Sandberg bluegrass	5
Prairie junegrass	5
Big sagebrush	5
Sedges	5
Annuals	Trace

Total annual yield on range in excellent condition is as much as 1,200 pounds air-dry herbage per acre. In less favorable years yield is as little as 600 pounds per acre.

Under continuous heavy use western wheatgrass and green needlegrass decrease in the plant community and are replaced by blue grama, Sandberg bluegrass, prairie junegrass, big sagebrush, and annuals.

In areas where a sufficient amount of the climax grasses remain, this site is suitable for such mechanical treatments as shallow chiseling, range pitting, and furrowing followed by deferred grazing. Where the range is in poor condition, complete seedbed preparation followed by seeding a suitable mixture of climax plants helps restore acceptable range condition. The management of big sagebrush may hasten improvement of the range.

DENSE CLAY SITE, 10- TO 14-INCH  
PRECIPITATION ZONE

This range site is made up of relatively impervious, deep clay that in places is overlain by a thin layer of other material. The soils are very hard to extremely

hard when dry and very sticky when wet. This site makes up about 0.5 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	Percent
Western wheatgrass	60
Forbs	15
Sandberg bluegrass	5
Squirreltail	5
Sedges	5
Big sagebrush	5
Greasewood	5
Annuals	Trace

Total yield on range in excellent condition is 1,200 pounds air-dry herbage per acre. In less favorable years yield is as low as 600 pounds per acre.

Under continuous heavy use western wheatgrass decreases in the plant community and is replaced by Sandberg bluegrass, blue grama, bottlebrush squirreltail, big sagebrush, cactus, curlycup gumweed, and other invaders.

This site is suitable for such mechanical treatments as shallow chiseling, pitting, or furrowing followed by periods of deferment. A good seedbed is difficult to prepare on this site, but there is rarely a need for range seeding unless the original vegetation has been destroyed by cultivation.

#### THIN BREAKS SITE, 10- TO 14-INCH PRECIPITATION ZONE

This range site is made up of soils of various depths that have hard outcroppings of bedrock at different levels and are on steep, irregular slopes. Trees occur locally in places above the outcrops. Soil texture ranges from sandy loam to clay loam. This site makes up about 1 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	Percent
Bluebunch wheatgrass	25
Western wheatgrass	25
Needleandthread	15
Blue grama	10
Threadleaf sedge	10
Green needlegrass	5
Side-oats grama	5
Prairie junegrass	5
Annuals	Trace

Total annual yield on range in excellent condition is 900 pounds air-dry herbage per acre. In less favorable years yield is as little as 300 pounds per acre.

The irregular topography characteristic of the site discourages overuse by grazing animals and makes this site unsuitable for mechanical practices and seeding.

#### SHALE SITE, 10- TO 14-INCH PRECIPITATION ZONE

This site is made up of soils that are shallow over shale on readily puddled uplands where weathered, angular raw shale fragments are exposed at the surface in places. This site makes up about 0.5 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	Percent
Western wheatgrass	25
Bluebunch wheatgrass	15
Alkali sacaton	15
Greasewood	15
Prairie sandreed	10
Green needlegrass	5
Short grasses	5
Forbs	5
Annuals	5

Total annual yield on range in excellent condition is about 500 pounds air-dry herbage per acre. In less favorable years yield is as little as 100 pounds per acre. About 75 percent of the plants in this site furnish forage for cattle, sheep, deer, and antelope.

Under continuous heavy use bluebunch wheatgrass and western wheatgrass decrease in the plant community and are replaced by annual forbs, blue grama, Sandberg bluegrass, or annual bromes.

The steep, rough topography limits the use of this site by livestock. Mechanical treatment and range seeding are not suitable on this range site.

#### WET LAND SITE, 15- TO 19-INCH PRECIPITATION ZONE

This range site is made up of lands where seepage, ponding, and flooding raise the water table above the surface during part of the growing season. This site is adjacent to perennial streams and on their flood plains. It makes up about 0.5 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	Percent
Sedges	50
Cordgrasses	25
Tall reedgrasses	10
Forbs	10
Woody plants	5
Invaders	Trace

Total annual yield on range in excellent condition is about 9,000 pounds air-dry herbage per acre. In less favorable years yield is as little as 3,000 pounds per acre. About 75 percent of the plants in this site furnish forage for cattle, deer, and antelope.

Under continuous heavy use cordgrasses, reedgrasses, and tall sedges decrease in the plant community and are replaced by silver sagebrush, Kentucky bluegrass, redtop, and annual vegetation.

This site is unsuitable for mechanical practices that would improve range condition because of the difficulty in tilling wet soil.

#### OVERFLOW SITE, 15- TO 19-INCH PRECIPITATION ZONE

This range site is made up of soils that regularly receive more than normal moisture in the form of runoff or stream overflow. This site makes up about 0.5 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	Percent
Western wheatgrass	25
Basin wildrye	15
Forbs	15
Little bluestem	10
Big bluestem	10
Sedges	10



Bearded wheatgrass	5
Shrubby cinquefoil	5
Woody plants	5

Total annual yield on range in excellent condition is about 4,200 pounds air-dry herbage per acre. In less favorable years yield is as little as 1,400 pounds per acre. About 90 percent of the plants in this site furnish forage for cattle, horses, sheep, deer, and antelope.

Under continuous heavy use the taller grasses decrease in the plant community and are replaced by silver sagebrush, snowberry, rosebush, Kentucky bluegrass, annuals, or noxious weeds.

This site responds to reseeding where the climax vegetation has been destroyed if a good seedbed is prepared and suitable native species are seeded.

#### SANDY SITE, 15- TO 19-INCH PRECIPITATION ZONE

This range site is made up of coarse sandy loam to fine sandy loam soils that are more than 20 inches deep over bedrock. This site makes up about 1 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	Percent
Prairie sandreed	20
Sand bluestem	15
Needleandthread	15
Idaho fescue	15
Big bluestem	10
Little bluestem	10
Forbs	10
Sedges	5

Total annual yield on range in excellent condition is about 3,000 pounds air-dry herbage per acre. In less favorable years yield is as little as 1,400 pounds per acre. Approximately 90 percent of the plants in this site furnish forage for cattle, horses, deer, and antelope.

Under continuous heavy use the bluestems, needleandthread, prairie sandreed, and sedges decrease in the plant community and are replaced in part by blue grama, forbs, sageworts, and annuals.

Recovery of excellent range condition is slow where the preferred climax species have been nearly grazed out. Under these conditions the range can be improved rapidly by seeding to suitable species. Brush management offers opportunities for range improvement where there is an excessive growth of rose, snowberry, or other brush species.

#### SILTY SITE, 15- TO 19-INCH PRECIPITATION ZONE

This range site is made up of moderately deep to deep soils that have a surface layer of loam, silt loam, or clay loam. These soils have good water infiltration rates and are capable of holding most of the normal precipitation. This site makes up about 5 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	Percent
Big bluestem	20
Idaho fescue	15
Western wheatgrass	15
Basin wildrye	10
Needleandthread	10

Green needlegrass	5
Bearded wheatgrass	5
Mountain brome	5
Little bluestem	5
Forbs	5
Woody plants	5

Total annual yield on range in excellent condition is as much as 3,000 pounds air-dry herbage per acre. In less favorable years yield is as little as 1,400 pounds per acre.

Under continuous use the bluestems, wheatgrasses, green needlegrass, and Idaho fescue decrease in the plant community and are replaced by the shorter grasses, forbs, and woody plants.

This site is suited to such mechanical treatments as shallow chiseling, range pitting, and furrowing followed by range deferment if enough of the preferred grasses remain. Preparation of a good seedbed followed by range seeding and deferment hasten the restoration of seriously depleted range. Brush management is practical and feasible on areas that have an excessive growth of woody vegetation.

#### CLAYEY SITE, 15- TO 19-INCH PRECIPITATION ZONE

This range site is made up of moderately deep to deep, well-drained clay loams, silty clay loams, silty clays, sandy clays, and clays. This site makes up about 7 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	Percent
Bluebunch wheatgrass	20
Western wheatgrass	20
Idaho fescue	20
Basin wildrye	10
Green needlegrass	5
Canby bluegrass	5
Plains reedgrass	5
Forbs	5
Big sagebrush	5
Woody plants	5

Total annual yield on range in excellent condition is about 3,000 pounds air-dry herbage per acre. In less favorable years yield is as little as 1,400 pounds per acre. Approximately 90 percent of the plants in this site furnish forage for grazing animals.

Under continuous heavy use the wheatgrasses, needlegrasses, basin wildrye, and other tall grasses decrease in the plant community and are replaced by short grasses, sageworts, and annual forbs and grasses.

Where the topography is favorable and sufficient desired species remain, range improvement can be hastened on this site by such mechanical treatments as furrowing or pitting. Where the climax plant community has been destroyed, complete seedbed preparation and range seeding are practical and provide rapid range improvement. Brush management is practical in areas that have an excessive growth of rosebush, snowberry, sagebrush, or other brush if some climax species are present.

#### THIN HILLY SITE, 15- TO 19-INCH PRECIPITATION ZONE

This range site is made up of calcareous loam to clay soils that are 20 inches deep or more. It is on steep or hilly landscapes. This site makes up approximately 9 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	Percent
Idaho fescue	20
Prairie sandreed	15
Western wheatgrass	15
Bluebunch wheatgrass	10
Little bluestem	10
Needleandthread	10
Forbs	10
Green needlegrass	5
Woody plants	5
Blue grama	Trace

Total annual yield on range in excellent condition is 1,800 pounds air-dry herbage per acre. In less favorable years yield is as little as 800 pounds per acre. About 90 percent of the plants in this site furnish forage for cattle, horses, sheep, deer, and antelope.

Under continuous heavy use bluebunch wheatgrass, prairie sandreed, green needlegrass, little bluestem, and western wheatgrass decrease in the plant community and are replaced by blue grama, sedges, forbs, annuals, and woody plants.

This site is not suitable for mechanical treatment because of the steep topography and the hazard of erosion. Range seeding and brush management may be justified under extreme conditions if quick range improvement is needed; however, these practices on this site involve considerable risk of increased erosion.

SHALLOW CLAY SITE, 15- TO 19-INCH  
PRECIPITATION ZONE

This range site is made up of granular clays that are 10 to 20 inches deep over underlying shale or nearly impervious clay. A few nearly barren areas occur in this range site. The site makes up about 1 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	Percent
Western wheatgrass	30
Bluebunch wheatgrass	15
Green needlegrass	10
Prairie sandreed	10
Forbs	10
Woody plants	10
Prairie junegrass	5
Plains reedgrass	5
Sandberg bluegrass	5

Total annual yield on range in excellent condition is about 2,300 pounds air-dry herbage per acre. In less favorable years yield is as little as 800 pounds per acre. Approximately 90 percent of the plants in this site furnish forage for cattle, horses, sheep, deer, and antelope.

Under continuous heavy use bluebunch wheatgrass, green needlegrass, and prairie sandreed decrease in the plant community and are partly replaced by prairie junegrass, plains reedgrass, Sandberg bluegrass, and annuals.

Limited depth and topography make this site unsuitable for mechanical tillage practices and range seeding. Brush management followed by deferred grazing is beneficial where there is an excessive growth of brush and some climax plants are present.

SHALLOW TO GRAVEL SITE, 15- TO 19-INCH  
PRECIPITATION ZONE

This range site is made up of soils that are 10 to 20 inches deep over sandy gravel. It is on the steep, dissected edges of gravel terraces and benches. This site makes up about 0.5 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	Percent
Bluebunch wheatgrass	20
Needleandthread	15
Western wheatgrass	15
Blue grama	15
Sandberg bluegrass	10
Sedges	10
Little bluestem	5
Prairie junegrass	5
Woody plants	5

Total annual yield on range in excellent condition is about 2,300 pounds air-dry herbage per acre. In less favorable years yield is as little as 800 pounds per acre. Approximately 90 percent of the plants in this site furnish forage for cattle, horses, sheep, deer, and antelope.

Under continuous heavy use bluebunch wheatgrass, little bluestem, needleandthread, and western wheatgrass decrease in the plant community and are replaced in part by blue grama, prairie junegrass, Sandberg bluegrass, sedges, fringed and green sagewort, and annuals.

This site is not suitable for mechanical treatment or range seeding.

SHALLOW SITE, 15- TO 19-INCH  
PRECIPITATION ZONE

This range site is made up of soils that are 10 to 20 inches deep over hard or soft bedrock of decomposed granite, siltstone, or sandstone. Few roots penetrate below a depth of 20 inches. This site makes up about 5 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	Percent
Bluebunch wheatgrass	30
Little bluestem	20
Idaho fescue	15
Western wheatgrass	10
Needleandthread	10
Prairie junegrass	5
Sedges	5
Forbs	5
Sandberg bluegrass	Trace
Woody plants	Trace

Total annual yield on range in excellent condition is about 2,300 pounds air-dry herbage per acre. In less favorable years yield is as little as 800 pounds per acre. Approximately 90 percent of the plants on this site furnish forage for cattle, sheep, horses, deer, and antelope.

Under continuous heavy use bluebunch wheatgrass, little bluestem, and needleandthread decrease in the plant community and are replaced in part by prairie junegrass, Sandberg bluegrass, sedges, and forbs.

PAN SPOTS SITE, 15- TO 19-INCH  
PRECIPITATION ZONE

This range site is made up of silty, clayey, or sandy soils in complex with soils in shallow depressions that



have hard clay or other impervious material at or near the surface. The shallow depressions occupy 20 to 50 percent of the site. This site makes up 0.5 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	Percent
Western wheatgrass	30
Needleandthread	20
Bluebunch wheatgrass	10
Little bluestem	10
Plains reedgrass	5
Blue grama	5
Sandberg bluegrass	5
Squirreltail	5
Saltgrass	5
Forbs	5
Woody plants	Trace

Total annual yield on range in excellent condition is about 2,200 pounds air-dry herbage per acre. In less favorable years yield is as little as 800 pounds per acre. Approximately 90 percent of the plants on this site furnish forage for cattle, horses, sheep, deer, and antelope.

Under continuous heavy use bluebunch wheatgrass, little bluestem, and needleandthread decrease in the plant community and are replaced in part by blue grama, Sandberg bluegrass, squirreltail, saltgrass, and forbs.

Range seeding and mechanical treatments are not suitable for this site unless the climax plants have been destroyed. Brush management followed by deferred grazing is advisable where there is an excessive cover of brush.

#### THIN BREAKS SITE, 15- TO 19-INCH PRECIPITATION ZONE

This range site is made up of soils of various depth that have outcrops of hard bedrock at different levels on steep, irregular slopes. Trees grow locally above the outcrops. The soils are loam, silt loam, silty clay loam, and clay loam. Slopes are mostly more than 15 percent. This site makes up about 3 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	Percent
Bluebunch wheatgrass	25
Idaho fescue	15
Basin wildrye	10
Green needlegrass	10
Needleandthread	10
Prairie sandreed	10
Western wheatgrass	5
Little bluestem	5
Dryland sedges	5
Prairie junegrass	5
Blue grama	Trace
Sandberg bluegrass	Trace

Total annual yield on range in excellent condition is as much as 1,200 pounds air-dry herbage per acre. In less favorable years yield is as little as 400 pounds.

The rough topography has discouraged overuse of this range by grazing animals. Proper grazing use and a system of deferred grazing maintain or improve the range vegetation. Mechanical renovation practices and seeding are not suitable because of the topography.

Under continuous heavy use nearly all the climax grasses decrease in the plant community and are replaced by annuals, red three-awn, broom snakeweed, and sandworts.

Where this site has deteriorated through overuse, it responds only slowly to proper grazing use and a deferred grazing system. It is not suitable for mechanical improvement practices or seeding because it is very shallow and has steep slopes.

#### SHALE SITE, 15- TO 19-INCH PRECIPITATION ZONE

This range site is made up of shallow, readily puddled soils that have some weathered, angular, raw shale fragments on the surface and areas of shale outcrop. This site makes up about 1 percent of the range in the Area. It is on uplands.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	Percent
Bluebunch wheatgrass	25
Western wheatgrass	25
Prairie sandreed	10
Alkali sacaton	10
Blue grama	10
Forbs	10
Idaho fescue	5
Green needlegrass	5

Total annual yield on range in excellent condition is about 700 pounds air-dry herbage per acre. In less favorable years yield is as little as 200 pounds per acre. About 75 percent of the plants on this site furnish forage for cattle, sheep, deer, and antelope.

Under continuous heavy use the desirable grass species that provide most of the forage decrease in the plant community and are replaced by blue grama, Sandberg bluegrass, and annuals.

Because the topography is rough, livestock rarely overgraze this site. Mechanical treatments and range seeding are not suitable for this site because of the topography and shallowness.

#### SANDY SITE, 20- TO 24-INCH PRECIPITATION ZONE

This range site is made up of coarse sandy loam to fine sandy loam more than 20 inches deep. This site makes up about 1 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	Percent
Forbs	25
Idaho fescue	20
Mountain bromes	15
Bearded wheatgrass	15
Richardson needlegrass	10
Big bluegrass	5
Alpine timothy	5
Letterman needlegrass	5

Total annual yield on range in excellent condition is about 4,000 pounds air-dry herbage per acre. In less favorable years yield is as little as 1,600 pounds per acre. Approximately 90 percent of the plants on this site furnish forage for cattle, horses, sheep, deer, elk, and buffalo.

Under continuous heavy use by cattle such tall grasses as mountain brome, big bluegrass, and bearded wheatgrass decrease in the plant community and are

replaced in part by lupines, cinquefoils, balsamroots, and yarrow.

**SILTY SITE, 20- TO 24-INCH PRECIPITATION ZONE**

This range site is made up of very fine sandy loam, loam, and silt loam soils that are more than 20 inches deep and some soils that have 2 inches or more of loam or silt loam over a subsoil of clay. These soils have moderate water infiltration rates and are capable of holding most of the normal precipitation. Runoff is heavy in spring when the snow melts. This site makes up about 4 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	Percent
Mountain brome	20
Richardson needlegrass	15
Forbs	15
Idaho fescue	15
Columbia needlegrass	10
Tufted hairgrass	10
Alpine timothy	5
Prairie junegrass	5
Canby bluegrass	5

Total annual yield on range in excellent condition is as much as 4,000 pounds per acre. In less favorable years yield is as little as 1,600 pounds per acre. Approximately 90 percent of the plants on this site furnish forage for cattle, horses, sheep, deer, elk, and buffalo.

Under continuous heavy use mountain brome, Columbia needlegrass, and tufted hairgrass decrease in the plant community and are partly replaced by big sagebrush, other brushes, and short grasses, such as Canby bluegrass, mat muhly, Idaho fescue, danthonias, and forbs. Forb increasers are lupine, cinquefoil, yarrow, little sunflower, and annuals.

Where the climax vegetation has been destroyed, range seeding improves the range vegetation in a minimum of time. Brush management along with deferred use hasten range improvement where there is an excessive growth of brush species and some climax grasses are present.

**SHALLOW SITE, 20- TO 24-INCH PRECIPITATION ZONE**

This range site is made up of soils that are 10 to 20 inches deep over hard bedrock or soft decomposed granite, siltstone, or sandstone. Few roots penetrate below a depth of 20 inches. This site makes up about 6 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	Percent
Bluebunch wheatgrass	20
Idaho fescue	20
Columbia needlegrass	15
Forbs	15
Woody plants	15
Letterman needlegrass	10
Prairie junegrass	5

Total annual yield on range in excellent condition is about 2,600 pounds air-dry herbage per acre. In less favorable years yield is as little as 1,000 pounds per acre. Approximately 80 percent of the plants in this

site furnish forage for cattle, horses, sheep, deer, elk, and buffalo.

Under continuous heavy use the wheatgrass, Columbia needlegrass, mountain brome, and sticky geranium decrease in the plant community and are partly replaced by prairie junegrass, danthonias, Idaho fescue, sagebrush, shrubby cinquefoil, prairie smoke, chickweed, and annuals.

Brush management is feasible in areas of this site that have a heavy growth of big sagebrush or shrubby cinquefoil if some climax grasses are present.

## Use of the Soils for Windbreaks

In this section the management of windbreaks is discussed, and the windbreak suitability groups in which soils of the Area have been placed are described.

### Tree windbreaks

Tree windbreaks are planted on farms and rangeland to control snow drifting and soil blowing. They are most effective where trees are planted in rows at right angles to the direction of the prevailing wind. In the Big Horn County Area windbreaks are generally required on dryfarmed soils in areas where the annual precipitation is less than 14 inches. They are particularly effective in controlling soil blowing on cultivated sandy soils. In irrigated valleys they are planted mainly around feedlots and for home beautification.

Soil characteristics that affect windbreak suitability are the amount of lime and depth to the zone of concentrated lime, depth to bedrock, the available water capacity, texture, content of coarse fragments, permeability, the degree of wetness, the alkali content and salinity of the soil, and slope.

Windbreaks typically consist of single or multiple-row plantings of shrubs, broadleaf trees, and evergreens. The most common and best suited shrubs are caragana, honeysuckle, lilac, chokecherry, skunkbush sumac, purple willow, and buffaloberry. Broadleaf trees suitable for planting are Russian-olive, Siberian elm, American elm, white willow, golden willow, cottonwood, and green ash. Suitable evergreen trees are ponderosa pine, Colorado blue spruce, Rocky Mountain juniper, and Scotch pine.

For suitability on specific sites, refer to the species listed in the description of each windbreak suitability group.

Site preparation, consisting of 1 year of fallow, should precede the planting. Multiple-row windbreaks should have at least one shrub row on the windward side and an evergreen row on the leeward, or inside. Between-row spacings, depending on the moisture available, range from 14 to 24 feet. In-row spacings are 2 to 4 feet for shrubs, 6 to 8 feet for low trees, and 8 to 12 feet for tall trees. Evergreen spacings are 8 to 10 feet for pine and spruce and 4 to 6 feet for juniper.

### Tall wheatgrass barriers

Grass barriers are helpful in controlling erosion on soils that are particularly susceptible to soil blowing. They also help to conserve moisture through snow accumulation, and they increase habitat for upland game



birds. Tall wheatgrass is recommended for this type of grass barrier. Spacings of the grass plantings at 60 foot intervals effectively reduces soil blowing.

### **Windbreak suitability groups**

The soils of the Big Horn County Area are placed in 10 groups according to their suitability for windbreak plantings. In the following paragraphs each windbreak suitability group is described, and the species of trees and shrubs most suitable to the group are listed. Windbreaks planted on any soil within a suitability group require similar management. Soils in windbreak suitability group 4 are not suitable for windbreak plantings. To identify the soils in a windbreak suitability group, refer to the "Guide to Mapping Units" at the back of this survey.

#### **WINDBREAK SUITABILITY GROUP 1**

This group consists of soils that have no or only slight soil and soil-related hazards or limitations. Available water capacity is 5 inches or more. Slopes are less than 15 percent.

These soils are well suited to windbreaks. Species suitable for planting on irrigated and dryfarmed soils of this group are caragana, honeysuckle, lilac, chokecherry, skunkbush sumac, buffaloberry, Russian-olive, Siberian elm, American elm, white willow, golden willow, cottonwood, green ash, ponderosa pine, Colorado blue spruce, Rocky Mountain juniper, and Scotch pine. Purple willow is suitable for planting on irrigated sites only.

#### **WINDBREAK SUITABILITY GROUP 2M**

This group consists of soils that have available water capacity of 5 inches or more and are either sandy loam or fine sandy loam, are gravelly, are moderately deep or deep over bedrock, or a combination of these. They are well drained. Any layer of lime accumulation is below a depth of 24 inches. Slopes are less than 15 percent.

Trees grow less well on these soils than on those in group 1. Species suitable for planting on irrigated and dryfarmed soils of this group are caragana, honeysuckle, lilac, chokecherry, skunkbush sumac, buffaloberry, Russian-olive, Siberian elm, green ash, ponderosa pine, Colorado blue spruce, Rocky Mountain juniper, and Scotch pine. Purple willow, American elm, white willow, golden willow, and cottonwood are suitable for planting on irrigated sites only.

#### **WINDBREAK SUITABILITY GROUP 2L**

This group consists of soils that have a layer of lime accumulation that is more than 15 percent calcium at a depth of 15 to 24 inches. Available water capacity is at least 5 inches. The soils are well drained. Slopes are less than 15 percent.

Species suitable for planting on irrigated and dryfarmed soils of this group are caragana, honeysuckle, lilac, chokeberry, skunkbush sumac, buffaloberry, Russian-olive, Siberian elm, green ash, ponderosa pine, and Rocky Mountain juniper.

#### **WINDBREAK SUITABILITY GROUP 2W**

This group consists of soils that have a water table at a depth of 36 to 60 inches. Available water capacity

is at least 5 inches. There is no horizon of lime accumulation within 15 inches of the surface. Slopes are less than 15 percent.

Species suitable for planting on irrigated and dryfarmed soils of this group are honeysuckle, lilac, chokecherry, skunkbush sumac, purple willow, buffaloberry, Russian-olive, Siberian elm, white willow, golden willow, cottonwood, green ash, ponderosa pine, Colorado blue spruce, Rocky Mountain juniper, and Scotch pine.

#### **WINDBREAK SUITABILITY GROUP 2S**

This group consists of soils that are limited because of salinity. The conductivity of a saturated extract ranges from 4 to 10 millimhos per centimeter at 25° C. Available water capacity is at least 5 inches. Any horizon of lime accumulation is at a depth of more than 15 inches. The water table is more than 36 inches below the surface. Slopes are less than 15 percent.

Species suitable for planting on irrigated and dryfarmed soils of this group are caragana, chokecherry, skunkbush sumac, buffaloberry, Russian-olive, Siberian elm, ponderosa pine, and Rocky Mountain juniper.

#### **WINDBREAK SUITABILITY GROUP 3M**

This group consists of soils that have available water capacity of 2 to 5 inches because of soil texture, depth, or both. Any horizon of lime accumulation is at a depth of more than 15 inches. These soils are well drained. Slopes are less than 15 percent.

Species suitable for planting on irrigated and dryfarmed soils of this group are caragana, buffaloberry, Russian-olive, Siberian elm, and Rocky Mountain juniper. Honeysuckle, lilac, chokecherry, skunkbush sumac, purple willow, white willow, golden willow, cottonwood, green ash, and Colorado blue spruce are suitable for planting on irrigated sites only.

#### **WINDBREAK SUITABILITY GROUP 3L**

This group consists of soils that have a horizon of lime accumulation that is more than 15 percent calcium carbonate at a depth of less than 15 inches. Any permanent water table is at a depth of more than 30 inches. Available water capacity is more than 5 inches. Slopes are less than 15 percent.

Species suitable for planting on irrigated and dryfarmed soils of this group are caragana, honeysuckle, lilac, skunkbush sumac, buffaloberry, Russian-olive, and Siberian elm.

#### **WINDBREAK SUITABILITY GROUP 3W**

This group consists of soils that have a water table at a depth of 12 to 36 inches during most of the growing season. Any horizon of lime accumulation is at a depth of more than 15 inches. Available water capacity is 2 inches or more. Slopes are less than 15 percent.

Species suitable for planting on irrigated and dryfarmed soils of this group are purple willow, buffaloberry, Russian-olive, Siberian elm, white willow, golden willow, cottonwood, Colorado blue spruce, and Rocky Mountain juniper.

#### **WINDBREAK SUITABILITY GROUP 3S**

This group consists of soils that are limited by salinity or alkalinity. The conductivity of a saturation



extract ranges from 10 to 16 millimhos per centimeter at 25° C., and the content of exchangeable sodium is more than 15 percent. Available water capacity is 5 inches or more. In places there is a horizon of carbonate accumulation at a depth of more than 15 inches. The water table is more than 20 inches below the surface. Slopes are less than 15 percent.

Species suitable for planting on irrigated and dry-farmed soils of this group are caragana, lilac, skunk-bush sumac, buffaloberry, Russian-olive, and Siberian elm. Cottonwood is suitable for planting on irrigated sites only.

#### WINDBREAK SUITABILITY GROUP 4

This group consists of soils that have slopes of more than 15 percent or soils that have lesser slopes and one or more very severe soil limitations. Among these limitations are available water capacity of less than 2 inches in soils that are shallow or very shallow and that in places are stony or gravelly; texture of dense fine clay; soils that are strongly saline and alkali; and presence of Rock outcrop.

### Use of the Soils for Woodland

Natural woodlands cover 252,500 acres of the Big Horn County Area. Of this, 212,500 acres is softwoods, and 40,000 acres is hardwoods, including brushy flood plains of rivers.

The softwoods consist of ponderosa pine, lodgepole pine, Douglas-fir, Rocky Mountain juniper, limber pine, Engelmann spruce, and subalpine fir. The species of commercial importance are Douglas-fir, ponderosa pine, lodgepole pine, and Rocky Mountain juniper.

The hardwoods consist of cottonwood, box elder, aspen, willow, and ash. They grow mainly in the valleys of the Little Big Horn and Big Horn Rivers. Small groves of quaking aspen are scattered on the mountains at elevations of less than 6,000 feet. Sawlog volume is low in all the stands.

In the Pryor Mountains is about 30,200 acres of softwoods, and the trees on 9,853 acres are of commercial quality. The species are lodgepole pine, ponderosa pine, Douglas-fir, and limber pine. Sawlog volume on the commercial-quality areas is relatively low, averaging only 2,440 board feet per acre. Most of the trees are less than 12 inches in diameter at breast height. The entire area is under the control of the Crow Indian Tribe.

The Big Horn Mountains have about 50,600 acres of forest land consisting mainly of Engelmann spruce, Douglas-fir, and lodgepole pine. The Garvin Basin on the west slopes of the mountains has scattered stands of Rocky Mountain juniper and Utah juniper. All of the land is owned by the Crow Indian Tribe. Although there is timber of commercial quality, the area is considered a prime recreation and big-game area, and no logging is permitted.

The Wolf Mountains contain about 25,000 acres of ponderosa pine, all of commercial quality. Of this acreage, about 14,500 acres is owned by the Crow Indian Tribe. Average volume is 3,296 board feet per acre.

The Pine Ridge area northwest of Hardin contains about 26,000 acres of privately owned ponderosa pine forest. The trees on about 25,000 acres are of commercial quality. Average volume is about 2,900 board feet per acre. The dominant trees are 10 to 12 inches in diameter at breast height.

Fire protection is considered to be adequate and effective on all the Indian land except in the deep, steep-walled canyons of the Pryor and Big Horn Mountains. The privately owned forest lands have no organized fire protection and control. They rely on county fire-fighting equipment for fire control.

At the present time no sawmills operate in the Area. Timber sales are held yearly in the Pryor and Wolf Mountains, and the logs are trucked to mills outside the Area. Studs, dimension lumber, house logs, fence posts, and corral posts are the main uses for the harvested timber. In the past a few Christmas trees have been harvested in the Pryor Mountains.

Information about woodland management for each forested soil series is contained in the mapping unit descriptions in the section "Descriptions of the Soils." Site index, principal species, timber harvest limitations, and other management information are given. A list of the forested mapping units is in the "Guide to Mapping Units."

### Use of the Soils for Recreation

The natural resources in the Big Horn County Area provide high potential for recreational development. The Big Horn Canyon Recreational Area, Big Horn Lake, the Wolf and Rosebud Mountains, the Tongue River, Lodgegrass Creek Reservoir, the Pryor and Big Horn Mountains, Custer Battlefield National Monument, and the Little Big Horn and Big Horn Rivers are among the many places that attract local and out-of-State visitors. Camping, picnicking, sightseeing, riding, hiking, and lodging facilities are needed in these places. The concentration of a large number of people in recreational areas subjects soils to stresses and produces limitations in soil management different from those that affect farm and engineering uses.

In table 3 the soils in the Big Horn County Area are rated for selected recreational uses. These are playgrounds, camp areas, picnic areas, and paths and trails. The ratings are given in terms of degree of limitation, which are slight, moderate, or severe. A rating of *slight* means the soils have few, if any, limitations for use that cannot be readily overcome. A rating of *moderate* indicates limitations that need to be recognized but can be overcome with good management or special design. A *severe* rating indicates the limitations are severe enough to make use questionable. A severe rating does not mean the soil cannot be used as intended, but it does mean that careful planning and design and very good management are needed. In some cases intense alterations are needed but may not be economically feasible.

For information about road construction, foundations for cottage and utility buildings, and septic tank filter fields, see table 5 in the section "Engineering Uses of the Soils."



TABLE 3.—*Limitations of the soils for selected recreational uses*

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Abac loam, rolling .....	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Abac loam, hilly .....	Severe: slopes are 15 to 40 percent.	Severe: slopes are 15 to 40 percent.	Severe: slopes are 15 to 40 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Abac-Bitton complex, hilly .....	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate: slopes are 15 to 35 percent.
Abac-Rock outcrop complex, very steep .....	Severe: slopes are 35 to 90 percent.	Severe: slopes are 35 to 90 percent.	Severe: slopes are 35 to 90 percent.	Severe: slopes are 35 to 90 percent.
Absarokee silty clay loam, gently undulating .....	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Absarokee silty clay loam, undulating .....	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Absarokee silty clay loam, rolling .....	Severe: slopes are 8 to 15 percent.	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Absarokee silty clay loam, hilly .....	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Absarokee-Castner complex, undulating .....	Moderate: slopes are 2 to 8 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Absarokee-Castner complex, hilly .....	Severe: slopes are 8 to 30 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 30 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 30 percent.	Slight where slopes are 8 to 15 percent. Moderate where slopes are 15 to 30 percent.
Absarokee-Armington association, gently sloping .....	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Absher-Nobe clays .....	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Adel-Mayflower association, sloping .....	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 15 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight.
Adger clay, 0 to 8 percent slopes .....	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Alice fine sandy loam, 4 to 15 percent slopes .....	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 15 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight.
Allentine clay, 0 to 2 percent slopes .....	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Allentine clay, 2 to 4 percent slopes .....	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Allentine-Bone complex, 0 to 1 percent slopes .....	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Allentine-Bone complex, 1 to 4 percent slopes .....	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Alluvial land, gravelly .....	Severe: flooding; coarse fragments on surface.	Severe: flooding; coarse fragments on surface.	Severe: coarse fragments on surface.	Severe: coarse fragments on surface.
Alluvial land, cobbly .....	Severe: flooding; coarse fragments on surface.	Severe: flooding; coarse fragments on surface.	Severe: coarse fragments on surface.	Severe: coarse fragments on surface.
Alluvial land, wet .....	Severe: water table; flooding.	Moderate: water table....	Moderate: water table....	Moderate: water table.

TABLE 3.—*Limitations of the soils for selected recreational uses—Continued*

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Amherst loam, undulating .....	Severe: bedrock at a depth of less than 20 inches.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Amherst loam, rolling .....	Severe: slopes are 8 to 15 percent; bedrock at a depth of less than 20 inches.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Amherst complex, rolling .....	Severe: slopes are 8 to 15 percent; bedrock at a depth of less than 20 inches.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Amherst complex, hilly .....	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Amherst-Maginnis complex, hilly .....	Severe: coarse fragments; bedrock at a depth of less than 20 inches.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Armington silty clay loam .....	Severe: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Armington complex, rolling .....	Severe: slopes are 8 to 15 percent; silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: clay surface layer.
Arnegard loam, 8 to 15 percent slopes .....	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Arnegard silt loam, 2 to 4 percent slopes .....	Moderate: slopes are 2 to 4 percent.	Slight .....	Slight .....	Slight.
Arnegard silt loam, 4 to 8 percent slopes .....	Moderate: slopes are 4 to 8 percent.	Slight .....	Slight .....	Slight.
Arvada silty clay loam .....	Severe: very slow permeability.	Severe: very slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Arvada-Bone clays .....	Severe: very slow permeability.	Severe: very slow permeability.	Severe: clay surface layer.	Severe: clay surface layer.
Ascalon sandy loam, 4 to 8 percent slopes .....	Moderate: slopes are 4 to 8 percent.	Slight .....	Slight .....	Slight.
Babb silt loam, rolling .....	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Babb silt loam, hilly .....	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Beauvais silty clay loam, gently undulating .....	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Beauvais silty clay loam, undulating .....	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Beauvais silty clay loam, rolling .....	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Beauvais-Gilt Edge silty clay loams, gently undulating .....	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Belfield silt loam, 0 to 1 percent slopes .....	Moderate: moderately slow permeability.	Moderate: moderately slow permeability.	Slight .....	Slight.
Belfield silt loam, gently undulating .....	Moderate: moderately slow permeability.	Moderate: moderately slow permeability.	Slight .....	Slight.
Belfield silt loam, undulating .....	Moderate: slopes are 4 to 8 percent.	Moderate: moderately slow permeability.	Slight .....	Slight.



TABLE 3.—*Limitations of the soils for selected recreational uses—Continued*

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Belfield-Adger complex, 0 to 1 percent slopes	Moderate: moderately slow or slow permeability.	Moderate: moderately slow or slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Belfield-Adger complex, gently undulating	Moderate: moderately slow or slow permeability.	Moderate: moderately slow or slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Belfield-Adger complex, undulating	Moderate: moderately slow or slow permeability.	Moderate: moderately slow or slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Benteen loam, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Benteen loam, hilly	Severe: slopes are 15 to 45 percent.	Severe: slopes are 15 to 45 percent.	Severe: slopes are 15 to 45 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are 25 to 45 percent.
Bew silty clay loam, 0 to 1 percent slopes	Moderate: slow permeability.	Moderate: slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Bew silty clay loam, gently undulating	Moderate: slow permeability.	Moderate: slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Bitton gravelly loam, 2 to 8 percent slopes	Moderate: slopes are 2 to 8 percent.	Moderate: coarse fragments on surface.	Moderate: coarse fragments on surface.	Moderate: coarse fragments on surface.
Bitton soils, hilly	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Bone clay	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Castner-Reeder loams, undulating	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Castner-Reeder loams, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Castner-Rock outcrop complex, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: coarse fragments on surface.
Castner-Vebar sandy loams, hilly	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Cherry silty clay loam, 2 to 8 percent slopes	Moderate: slopes are 2 to 8 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Chugter loam, 2 to 8 percent slopes	Moderate: slopes are 2 to 8 percent.	Slight	Slight	Slight.
Chugter complex, 2 to 15 percent slopes	Moderate where slopes are 2 to 8 percent. Severe where slopes are 8 to 15 percent.	Slight where slopes are 2 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight where slopes are 2 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight.
Clapper-Harvey complex, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Clapper-Midway complex, hilly	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Colby silt loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Colby silt loam, 8 to 15 percent slopes	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Colby silty clay loam, 1 to 4 percent slopes	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.

TABLE 3.—*Limitations of the soils for selected recreational uses—Continued*

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Colby silty clay loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Colby silty clay loam, 8 to 15 percent slopes	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Colby-Beauvais silt loams, undulating	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Colby-Beauvais silt loams, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Colby-Clapper silt loams, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Colby-Keiser silty clay loams, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Colby-Midway complex, 8 to 15 percent slopes	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Colby association, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Colby association, hilly	Severe: slopes are 15 to 35 percent; coarse fragments on surface.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Cushman loam, undulating	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Danvers silty clay loam, 0 to 1 percent slopes	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Danvers silty clay loam, gently undulating	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Danvers silty clay loam, undulating	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Danvers cobbly silty clay loam, 1 to 4 percent slopes	Severe: coarse fragments on surface.	Moderate: coarse fragments on surface.	Moderate: coarse fragments on surface.	Moderate: coarse fragments on surface.
Danvers-Judith silty clay loams, gently undulating	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Danvers-Judith silty clay loams, undulating	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Danvers-Judith silty clay loams, hilly	Severe: slopes are 8 to 20 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 20 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 20 percent.	Moderate: silty clay loam surface layer.
Dast sandy loam, rolling	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 15 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight.
Dast sandy loam, hilly	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Dast complex, hilly	Severe: slopes are 25 to 50 percent.	Severe: slopes are 25 to 50 percent.	Severe: slopes are 25 to 50 percent.	Severe: slopes are 25 to 50 percent.
Dast complex, very steep	Severe: slopes are 15 to 90 percent.	Severe: slopes are 15 to 90 percent.	Severe: slopes are 15 to 90 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are 25 to 90 percent.
Dast-Parshall sandy loams, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Doney loam, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.



TABLE 3.—*Limitations of the soils for selected recreational uses—Continued*

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Doney silty clay loam, hilly .....	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Doney-Reeder loams, rolling .....	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Doney-Ringling complex, rolling .....	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Doney-Ringling complex, hilly .....	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Doney-Ringling complex, very steep .....	Severe: slopes are 35 to 90 percent.	Severe: slopes are 35 to 90 percent.	Severe: slopes are 35 to 90 percent.	Severe: slopes are 35 to 90 percent.
Doney-Rock outcrop complex, very steep .....	Severe: slopes are more than 30 percent.	Severe: slopes are more than 30 percent.	Severe: slopes are more than 30 percent.	Severe: slopes are more than 30 percent.
Doney-Wayden complex, hilly .....	Severe: slopes are 8 to 35 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 35 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 35 percent.	Slight where slopes are 8 to 15 percent. Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Duncom extremely chan- nery loam, rolling .....	Severe: slopes are 8 to 15 percent; coarse fragments on surface.	Severe: coarse frag- ments on surface.	Severe: coarse frag- ments on surface.	Severe: coarse frag- ments on surface.
Duncom complex, rolling .....	Severe: slopes are 8 to 15 percent; bedrock at a depth of less than 20 inches.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: coarse frag- ments on surface.
Duncom-Tarrete association, rolling .....	Severe: slopes are 8 to 15 percent; bedrock at a depth of less than 20 inches.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: coarse frag- ments on surface.
Duncom-Tarrete association, hilly .....	Severe: slopes are 15 to 35 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Elsac clay, undulating .....	Severe: clay surface layer.	Severe: clay surface layer; very slow permeability.	Severe: clay surface layer.	Severe: clay surface layer.
Elsac clay, rolling .....	Severe: slopes are 8 to 15 percent.	Severe: very slow permeability; clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Elsac cobbly clay, hilly .....	Severe: slopes are 15 to 35 percent; coarse fragments on surface.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: clay surface layer.
Farnuf loam, 0 to 2 percent slopes .....	Slight .....	Slight .....	Slight .....	Slight.
Farnuf loam, 2 to 4 percent slopes .....	Moderate: slopes are 2 to 4 percent.	Slight .....	Slight .....	Slight.
Farnuf loam, 4 to 8 percent slopes .....	Moderate: slopes are 4 to 8 percent.	Slight .....	Slight .....	Slight.
Farnuf-Doney association, sloping .....	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Fergus silt loam, 2 to 4 percent slopes .....	Moderate: slopes are 2 to 4 percent.	Slight .....	Slight .....	Slight.
Fergus silt loam, 4 to 8 percent slopes .....	Moderate: slopes are 4 to 8 percent.	Slight .....	Slight .....	Slight.

TABLE 3.—*Limitations of the soils for selected recreational uses—Continued*

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Fergus silt loam, 8 to 15 percent slopes	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Fort Collins loam, 0 to 2 percent slopes	Slight	Slight	Slight	Slight.
Fort Collins loam, 2 to 4 percent slopes	Moderate: slopes are 2 to 4 percent.	Slight	Slight	Slight.
Fort Collins loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Fort Collins loam, channeled, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Frazer silty clay loam	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer; slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Frazer silty clay loam, saline	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.
Frazer silty clay	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.
Frazer and Korchea soils, channeled	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Gilt Edge silty clay loam, 0 to 2 percent slopes	Moderate: slow permeability; silty clay loam surface layer.	Moderate: slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Gilt Edge silty clay loam, 2 to 4 percent slopes	Moderate: slow permeability; silty clay loam surface layer.	Moderate: slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Gilt Edge-Bone complex, 0 to 1 percent slopes	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Gilt Edge-Bone complex, 1 to 4 percent slopes	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Glenberg fine sandy loam, 0 to 2 percent slopes	Slight	Slight	Slight	Slight.
Glenberg fine sandy loam, 2 to 4 percent slopes	Moderate: slopes are 2 to 4 percent.	Slight	Slight	Slight.
Glenberg fine sandy loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Glenberg loam, 0 to 2 percent slopes	Slight	Slight	Slight	Slight.
Grail clay loam, 0 to 2 percent slopes	Moderate: clay loam surface layer.	Moderate: clay loam surface layer.	Moderate: clay loam surface layer.	Moderate: clay loam surface layer.
Grail clay loam, 2 to 8 percent slopes	Moderate: slopes are 2 to 8 percent.	Moderate: clay loam surface layer.	Moderate: clay loam surface layer.	Moderate: clay loam surface layer.
Grail clay loam, 8 to 15 percent slopes	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: clay loam surface layer.
Grail clay loam, 15 to 35 percent slopes	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Grail silty clay, 0 to 2 percent slopes	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.
Hanson extremely stony loam, rolling	Severe: slopes are 8 to 15 percent; coarse fragments on surface.	Severe: coarse fragments on surface.	Severe: coarse fragments on surface.	Severe: coarse fragments on surface.



TABLE 3.—*Limitations of the soils for selected recreational uses—Continued*

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Hanson-Babb association, very steep .....	Severe: slopes are 35 to 70 percent.	Severe: slopes are 35 to 70 percent.	Severe: slopes are 35 to 70 percent.	Severe: slopes are 35 to 70 percent.
Harvey loam, gently undulating .....	Moderate: slopes are 2 to 4 percent.	Slight.....	Slight.....	Slight.
Harvey loam, undulating ..	Moderate: slopes are 4 to 8 percent.	Slight.....	Slight.....	Slight.
Harvey loam, rolling .....	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Harvey gravelly loam, undulating .....	Moderate: slopes are 2 to 8 percent.	Slight.....	Slight.....	Slight.
Harvey complex, undulating .....	Moderate: slopes are 4 to 8 percent.	Slight.....	Slight.....	Slight.
Haverson loam, 0 to 2 percent slopes .....	Slight.....	Slight.....	Slight.....	Slight.
Haverson loam, 2 to 4 percent slopes .....	Moderate: slopes are 2 to 4 percent.	Slight.....	Slight.....	Slight.
Haverson loam, saline .....	Slight.....	Slight.....	Slight.....	Slight.
Haverson silty clay loam ..	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Haverson silty clay .....	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.
Haverson silty clay, thick surface .....	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.
Haverson-Hysham silty clay loams .....	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Haverson and Glenberg soils .....	Moderate: flooding hazard.	Moderate: flooding hazard.	Slight .....	Slight.
Haverson and Lohmiller soils, channeled .....	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Haverson and Lohmiller soils, frequently flooded .....	Severe: flooding .....	Severe: flooding .....	Moderate: flooding .....	Moderate: flooding.
Haverson and Lohmiller soils, wet .....	Severe: water table above a depth of 20 inches.	Severe: water table above a depth of 20 inches.	Severe: water table above a depth of 20 inches.	Severe: water table above a depth of 20 inches.
Haverson soils, saline .....	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Heldt silty clay loam, 0 to 2 percent slopes .....	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Heldt silty clay loam, 2 to 4 percent slopes .....	Moderate: silty clay loam surface layer; slopes are 2 to 4 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Heldt silty clay loam, 4 to 8 percent slopes .....	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Heldt silty clay loam, 8 to 15 percent slopes .....	Severe: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Heldt silty clay, 0 to 2 percent slopes .....	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.
Heldt-Hysham silty clay loams, 0 to 2 percent slopes .....	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.

TABLE 3.—*Limitations of the soils for selected recreational uses—Continued*

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Heldt-Hysham silty clay loams, 2 to 4 percent slopes	Moderate: silty clay loam surface layer; slopes are 2 to 4 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Hester silty clay loam, 0 to 1 percent slopes	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Hester silty clay loam, 1 to 4 percent slopes	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Hester silty clay loam, 4 to 8 percent slopes	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Hydro loam, 0 to 8 percent slopes	Moderate: slow permeability.	Moderate: slow permeability.	Slight	Slight.
Hydro silt loam, 0 to 2 percent slopes	Moderate: slow permeability.	Moderate: slow permeability.	Slight	Slight.
Hydro silt loam, 2 to 4 percent slopes	Moderate: slopes are 2 to 4 percent; slow permeability.	Moderate: slow permeability.	Slight	Slight.
Hydro silt loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Moderate: slow permeability.	Slight	Slight.
Hydro silty clay loam, 0 to 2 percent slopes	Moderate: slow permeability.	Moderate: slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Hydro silty clay loam, 2 to 4 percent slopes	Moderate: slopes are 2 to 4 percent; slow permeability.	Moderate: slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Hydro-Allentine complex, 1 to 4 percent slopes	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.
Hydro-Allentine complex, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent; clay loam surface layer.	Moderate: slow permeability.	Moderate: clay loam surface layer.	Moderate: clay loam surface layer.
Hydro-Gilt Edge complex, 0 to 1 percent slopes	Moderate: slow permeability.	Moderate: slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Hysham loam, 0 to 2 percent slopes	Moderate: slow permeability.	Moderate: slow permeability.	Slight	Slight.
Hysham silty clay loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent; silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Hysham silty clay loam, channeled, 0 to 4 percent slopes	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Hysham-Midway silty clay loams, 4 to 15 percent slopes	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer; slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Hysham and Lohmiller silty clay loams, 0 to 8 percent slopes	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Judith clay loam, 0 to 2 percent slopes	Moderate: clay loam surface layer.	Moderate: clay loam surface layer.	Moderate: clay loam surface layer.	Moderate: clay loam surface layer.
Judith clay loam, 2 to 4 percent slopes	Moderate: slopes are 2 to 4 percent.	Moderate: clay loam surface layer.	Moderate: clay loam surface layer.	Moderate: clay loam surface layer.
Judith clay loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Moderate: clay loam surface layer.	Moderate: clay loam surface layer.	Moderate: clay loam surface layer.



TABLE 3.—*Limitations of the soils for selected recreational uses—Continued*

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Judith-Windham complex, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Moderate: coarse fragments; clay loam surface layer.	Moderate: coarse fragments; clay loam surface layer.	Moderate: clay loam surface layer.
Judith-Windham complex, 8 to 15 percent slopes	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: coarse fragments.
Keiser silty clay loam, 0 to 2 percent slopes	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Keiser silty clay loam, 2 to 4 percent slopes	Moderate: slopes are 2 to 4 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Keiser silty clay loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Keiser-Colby complex, gently undulating	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Kim loam, 4 to 15 percent slopes	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 15 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight.
Korchea loam, 0 to 2 percent slopes	Slight	Slight	Slight	Slight.
Korchea loam, 2 to 4 percent slopes	Moderate: slopes are 2 to 4 percent.	Slight	Slight	Slight.
Korchea silt loam, 0 to 2 percent slopes	Slight	Slight	Slight	Slight.
Korchea silt loam, frequently flooded	Moderate: flooding hazard.	Severe: flooding hazard	Moderate: flooding hazard.	Slight.
Korchea silty clay loam, 0 to 2 percent slopes	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Korchea silty clay loam, 2 to 4 percent slopes	Moderate: silty clay loam surface layer; slopes are 2 to 4 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Korchea and Frazer soils, water table	Severe: water table above a depth of 20 inches.	Severe: water table above a depth of 20 inches.	Severe: water table above a depth of 20 inches.	Severe: water table above a depth of 20 inches.
Kyle silty clay, 0 to 2 percent slopes	Severe: silty clay surface layer; very slow permeability.	Severe: silty clay surface layer; very slow permeability.	Severe: silty clay surface layer.	Severe: silty clay surface layer.
Kyle silty clay, 2 to 4 percent slopes	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.
Kyle silty clay, 4 to 8 percent slopes	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.
Kyle gravelly silty clay, 8 to 15 percent slopes	Severe: slopes are 8 to 15 percent.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.
Kyle clay, saline	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
La Fonda loam, 2 to 4 percent slopes	Moderate: slopes are 2 to 4 percent.	Slight	Slight	Slight.
Lap-Trulon complex, rolling	Severe: bedrock at a depth of less than 20 inches.	Moderate: coarse fragments on surface.	Moderate: coarse fragments on surface.	Moderate: coarse fragments on surface.
Lap association, undulating	Severe: bedrock at a depth of less than 20 inches.	Moderate: coarse fragments on surface.	Moderate: coarse fragments on surface.	Moderate: coarse fragments on surface.

TABLE 3.—*Limitations of the soils for selected recreational uses—Continued*

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Lap association, rolling	Severe: slopes are 8 to 20 percent; bedrock at a depth of less than 20 inches.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 20 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 20 percent.	Moderate: coarse fragments on surface.
Lap-Armington association, rolling	Severe: slopes are 8 to 35 percent; bedrock at a depth of less than 20 inches.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 35 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 35 percent.	Slight where slopes are 8 to 15 percent. Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Lavina-Travessilla loams, undulating	Severe: bedrock at a depth of less than 20 inches.	Slight	Slight	Slight.
Lennepe loam, 2 to 4 percent slopes	Moderate: slopes are 2 to 4 percent; slow permeability.	Moderate: slow permeability.	Slight	Slight.
Lennepe loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Moderate: slow permeability.	Slight	Slight.
Lennepe-Adger complex, gently undulating	Moderate: slow permeability.	Moderate: slow permeability.	Slight	Slight.
Lennepe-Adger complex, undulating	Moderate: slopes are 4 to 8 percent.	Moderate: slow permeability.	Slight	Slight.
Lisimas clay, undulating	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Lisimas gravelly clay, rolling	Severe: slopes are 8 to 15 percent.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Lisimas gravelly clay, hilly	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: clay surface layer.
Lisimas-Shale outcrop complex, rolling	Severe: slopes are 8 to 20 percent.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Lisimas-Shale outcrop complex, steep	Severe: slopes are 20 to 75 percent.	Severe: slopes are 20 to 75 percent.	Severe: slopes are 20 to 75 percent.	Severe: clay surface layer.
Lisimas-Vananda clays, undulating	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Lohmiller silty clay loam, 0 to 2 percent slopes	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Lohmiller silty clay loam, 2 to 4 percent slopes	Moderate: slopes are 2 to 4 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Lohmiller silty clay loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Lohmiller silty clay loam, 8 to 15 percent slopes	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Lohmiller silty clay, saline, 0 to 2 percent slopes	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.
Lohmiller silty clay, saline, 2 to 4 percent slopes	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.
Lohmiller-Midway silty clay loams, undulating	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Macar loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.



TABLE 3.—*Limitations of the soils for selected recreational uses—Continued*

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Maginnis-Shale outcrop complex, very steep .....	Severe: slopes are more than 35 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are more than 35 percent.	Severe: slopes are more than 35 percent.	Severe: slopes are more than 35 percent.
Maginnis-Windham complex, hilly .....	Severe: slopes are more than 15 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are more than 15 percent.	Severe: slopes are more than 15 percent.	Severe: silty clay surface layer; coarse fragments on surface.
Marias clay, 0 to 2 percent slopes .....	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Marias clay, 2 to 4 percent slopes .....	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Marias clay, 4 to 8 percent slopes .....	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Marias clay, 8 to 15 percent slopes .....	Severe: slopes are 8 to 15 percent.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Maschetah complex, rolling .....	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Maschetah-Norbert complex, hilly .....	Severe: slopes are 15 to 35 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Mayflower silt loam, rolling .....	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Mayflower association, rolling .....	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
McKenzie clay .....	Severe: flooding hazard; poorly drained.	Severe: very slow permeability.	Severe: poorly drained.	Severe: poorly drained.
McRae loam, 0 to 1 percent slopes .....	Slight .....	Slight .....	Slight .....	Slight.
McRae loam, 1 to 4 percent slopes .....	Slight where slopes are 1 to 2 percent. Moderate where slopes are 2 to 4 percent.	Slight .....	Slight .....	Slight.
McRae loam, 4 to 8 percent slopes .....	Moderate: slopes are 4 to 8 percent.	Slight .....	Slight .....	Slight.
McRae silty clay loam, 0 to 1 percent slopes .....	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Midway silty clay loam, undulating .....	Severe: bedrock at a depth of less than 20 inches.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Midway silty clay loam, rolling .....	Severe: slopes are 8 to 15 percent; bedrock at a depth of less than 20 inches.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Midway silty clay loam, hilly .....	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Midway-Lismas complex, rolling .....	Severe: slopes are 8 to 15 percent.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Midway-Lismas complex, hilly .....	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: clay surface layer.

TABLE 3.—*Limitations of the soils for selected recreational uses—Continued*

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Midway-Thedalund complex, rolling	Severe: slopes are 8 to 15 percent; bedrock at a depth of less than 20 inches.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: clay loam surface layer.
Midway-Thedalund complex, hilly	Severe: slopes are 8 to 35 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 35 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 35 percent.	Slight where slopes are 8 to 15 percent. Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Midway-Thurlow association, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Morton silt loam, undulating	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 15 percent.	Slight	Slight	Slight.
Nelson fine sandy loam, undulating	Moderate where slopes are 2 to 8 percent. Severe where slopes are 8 to 15 percent.	Slight where slopes are 2 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight where slopes are 2 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight.
Nelson-Alice fine sandy loams, rolling	Severe: slopes are 8 to 20 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 20 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 20 percent.	Slight.
Nelson-Glenberg sandy loams, undulating	Severe: slopes are 8 to 20 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 20 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 20 percent.	Slight.
Neville loam, rolling	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 15 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight.
Norbert-Eltsac clays, hilly	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: clay surface layer.
Norbert-Shale outcrop complex, steep	Severe: slopes are 15 to 75 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are 15 to 75 percent.	Severe: slopes are 15 to 75 percent.	Severe: clay surface layer.
Nunn silty clay loam, 0 to 1 percent slopes	Moderate: silty clay loam surface layer; slow permeability.	Moderate: silty clay loam surface layer; slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Nunn silty clay loam, 1 to 4 percent slopes	Moderate: silty clay loam surface layer; slow permeability.	Moderate: silty clay loam surface layer; slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Nunn silty clay loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer; slow permeability.	Moderate: silty clay loam surface layer.
Nunn silty clay loam, 8 to 15 percent slopes	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Nunn-Midway silty clay loams, 4 to 15 percent slopes	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Olney fine sandy loam, 4 to 12 percent slopes	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 12 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 12 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 12 percent.	Slight.



TABLE 3.—*Limitations of the soils for selected recreational uses—Continued*

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Parshall fine sandy loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Peritsa silt loam, undulating	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Peritsa-Abac loams, rolling	Severe: slopes are 8 to 20 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 20 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 20 percent.	Slight.
Peritsa complex, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Pierre clay, undulating	Severe: clay surface layer.	Severe: clay surface layer; very slow permeability.	Severe: clay surface layer.	Severe: clay surface layer.
Pierre clay, rolling	Severe: slopes are 8 to 15 percent.	Severe: clay surface layer; very slow permeability.	Severe: clay surface layer.	Severe: clay surface layer.
Pierre-Kyle clays, gently undulating	Severe: clay surface layer; very slow permeability.	Severe: clay surface layer; very slow permeability.	Severe: clay surface layer.	Severe: clay surface layer.
Pierre-Lismas clays, rolling	Severe: slopes are 8 to 15 percent.	Severe: clay surface layer; very slow permeability.	Severe: clay surface layer.	Severe: clay surface layer.
Pierre-Lismas clays, hilly	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: clay surface layer.
Pultney-Neville association, undulating	Moderate: slopes are 2 to 8 percent.	Slight	Slight	Slight.
Quietus loam	Severe: slopes are 15 to 45 percent.	Severe: slopes are 15 to 45 percent.	Severe: slopes are 15 to 45 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are 25 to 45 percent.
Raynesford loam, undulating	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Reeder loam, gently undulating	Moderate: slopes are 2 to 4 percent; bedrock at a depth of less than 20 to 40 inches.	Slight	Slight	Slight.
Reeder loam, undulating	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Reeder loam, hilly	Severe: slopes are 15 to 25 percent.	Severe: slopes are 15 to 25 percent.	Severe: slopes are 15 to 25 percent.	Moderate: slopes are 15 to 25 percent.
Reeder-Regent complex, rolling	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Reeder-Rentsac complex, undulating	Severe: bedrock at a depth of less than 20 inches.	Slight	Slight	Slight.
Reeder-Darret association, undulating	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Reeder-Darret association, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Regent silty clay loam, gently undulating	Moderate: slopes are 2 to 4 percent.	Moderate: slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Regent silty clay loam, undulating	Moderate: slopes are 4 to 8 percent.	Moderate: slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.

TABLE 3.—*Limitations of the soils for selected recreational uses—Continued*

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Regent silty clay loam, rolling .....	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Renohill silty clay loam, undulating .....	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer; slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Rentsac-Doney complex, rolling .....	Severe: slopes are 8 to 15 percent; bedrock at a depth of less than 20 inches.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Richfield silty clay loam, 0 to 2 percent slopes .....	Moderate: silty clay loam surface layer; moderately slow permeability.	Moderate: silty clay loam surface layer; moderately slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Richfield silty clay loam, gently undulating .....	Moderate: slopes are 2 to 4 percent.	Moderate: silty clay loam surface layer; moderately slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Richfield silty clay loam, undulating .....	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer; moderately slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Richfield-Beauvais silty clay loams, gently undulating .....	Moderate: silty clay loam surface layer; slopes are 2 to 4 percent.	Moderate: silty clay loam surface layer; moderately slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Richfield-Beauvais silty clay loams, undulating .....	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer; moderately slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Riverwash .....	Severe: flooding hazard.	Severe: flooding hazard.	Severe: flooding hazard.	Severe: flooding hazard.
Rock outcrop-Duncom complex, very steep .....	Severe: slopes are more than 35 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are more than 35 percent.	Severe: slopes are more than 35 percent.	Severe: slopes are more than 35 percent.
Rock outcrop-Lap complex, very steep .....	Severe: slopes are more than 35 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are more than 35 percent.	Severe: slopes are more than 35 percent.	Severe: slopes are more than 35 percent.
Rock outcrop-Pultney complex, very steep .....	Severe: slopes are more than 35 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are more than 35 percent.	Severe: slopes are more than 35 percent.	Severe: slopes are more than 35 percent.
Rock outcrop-Rentsac complex, rolling .....	Severe: bedrock at a depth of less than 20 inches.	Severe: coarse fragments on surface.	Severe: coarse fragments on surface.	Severe: coarse fragments on surface.
Rock outcrop-Windham complex, very steep .....	Severe: slopes are more than 35 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are more than 35 percent.	Severe: slopes are more than 35 percent.	Severe: slopes are more than 35 percent.
Rottulee silt loam, gently undulating .....	Moderate: slopes are 2 to 4 percent; dusty when dry.	Slight .....	Slight .....	Slight.
Rottulee silt loam, undulating .....	Moderate: slopes are 4 to 8 percent.	Slight .....	Slight .....	Slight.
Rottulee silt loam, rolling .....	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.



TABLE 3.—*Limitations of the soils for selected recreational uses—Continued*

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Rottulee-Abac complex, rolling .....	Severe: slopes are 8 to 15 percent; bedrock at a depth of less than 20 inches.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Ryorp sandy loam, undulating .....	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 15 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight.
Saline land .....	Severe: mostly clay surface layer.	Severe: mostly clay surface layer.	Severe: mostly clay surface layer.	Severe: mostly clay surface layer.
Savage silty clay loam, 0 to 2 percent slopes .....	Moderate: silty clay loam surface layer; slow permeability.	Moderate: silty clay loam surface layer; slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Savage silty clay loam, 2 to 4 percent slopes .....	Moderate: silty clay loam surface layer; slopes are 2 to 4 percent.	Moderate: silty clay loam surface layer; slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Savage silty clay loam, 4 to 8 percent slopes .....	Moderate: slopes are 4 to 8 percent; silty clay loam surface layer.	Moderate: silty clay loam surface layer; slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Savage silty clay loam, undulating .....	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer; slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Savage silty clay loam, rolling .....	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Savage-Wayden silty clay loams, 4 to 15 percent slopes .....	Severe: bedrock at a depth of less than 20 inches.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Savage and Frazer soils, 0 to 4 percent slopes .....	Severe: flooding hazard	Severe: flooding hazard	Moderate: flooding hazard; silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Searing loam, undulating .....	Moderate: slopes are 4 to 8 percent.	Slight .....	Slight .....	Slight.
Searing loam, hilly .....	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Searing-Ringling complex, rolling .....	Severe: slopes are 8 to 15 percent; bedrock at a depth of less than 20 inches.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Shaak clay loam, 4 to 8 percent slopes .....	Moderate: slopes are 4 to 8 percent.	Moderate: clay loam surface layer; slow permeability.	Moderate: clay loam surface layer.	Moderate: clay loam surface layer.
Shaak silty clay loam, 0 to 2 percent slopes .....	Moderate: silty clay loam surface layer; slow permeability.	Moderate: silty clay loam surface layer; slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Shaak silty clay loam, gently undulating .....	Moderate: silty clay loam surface layer; slopes are 2 to 4 percent.	Moderate: silty clay loam surface layer; slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Shaak silty clay loam, undulating .....	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Shaak silty clay loam, rolling .....	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Shaak complex, 4 to 15 percent slopes .....	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 15 percent.	Moderate: clay loam surface layer.	Moderate: clay loam surface layer.	Moderate: clay loam surface layer.

TABLE 3.—*Limitations of the soils for selected recreational uses—Continued*

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Shale outcrop .....	Severe: bedrock at surface.	Severe: slopes are more than 35 percent.	Severe: slopes are more than 35 percent.	Severe: slopes are more than 35 percent.
Shale outcrop-Midway complex, steep .....	Severe: slopes are 25 to 90 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are 25 to 90 percent.	Severe: slopes are 15 to 90 percent.	Severe: slopes are 25 to 90 percent.
Shale outcrop-Norbert complex, hilly .....	Severe: slopes are 15 to 35 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 25 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Shonkin clay loam .....	Severe: water table above a depth of 20 inches.	Severe: water table above a depth of 20 inches.	Moderate: water table above a depth of 20 inches.	Moderate: water table above a depth of 20 inches.
Sofia silty clay, 0 to 2 percent slopes .....	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.
Sofia silty clay, gently undulating .....	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.
Spearfish-Clapper complex, hilly .....	Severe: slopes are 15 to 35 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Spearfish-Rock outcrop complex, very steep .....	Severe: slopes are 35 to 90 percent.	Severe: slopes are 35 to 90 percent.	Severe: slopes are 35 to 90 percent.	Severe: slopes are 35 to 90 percent.
Spearfish-Pultney association, rolling .....	Severe: slopes are 8 to 25 percent; bedrock at a depth of less than 20 inches.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 25 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 25 percent.	Slight where slopes are 8 to 15 percent. Moderate where slopes are 15 to 25 percent.
Spearfish-Pultney association, hilly .....	Severe: slopes are 15 to 50 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are 15 to 50 percent.	Severe: slopes are 15 to 50 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Spearman loam, undulating .....	Moderate: slopes are 4 to 8 percent.	Slight .....	Slight .....	Slight.
Spearman-Wibaux complex, rolling .....	Severe: bedrock at a depth of less than 20 inches.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight.
Splitro-Sawcreek sandy loams, rolling .....	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Splitro-Sawcreek sandy loams, hilly .....	Severe: slopes are 15 to 35 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Stormitt extremely stony loam, hilly .....	Severe: slopes are 8 to 35 percent; coarse fragments on surface.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 35 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 35 percent.	Moderate: coarse fragments on surface.
Stormitt complex, 0 to 4 percent slopes .....	Severe: coarse fragments on surface.	Moderate: coarse fragments on surface.	Moderate: coarse fragments on surface.	Moderate: coarse fragments on surface.
Stormitt complex, 4 to 15 percent slopes .....	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 15 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight.
Talag clay, 0 to 8 percent slopes .....	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Talag-Allentine complex, 0 to 4 percent slopes .....	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.



TABLE 3.—*Limitations of the soils for selected recreational uses—Continued*

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Tarrete silty clay loam, 8 to 15 percent slopes	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Terrace escarpments, gravelly	Severe: coarse fragments on surface.	Severe: coarse fragments on surface.	Severe: coarse fragments on surface.	Severe: coarse fragments on surface.
Terrace escarpments, loamy	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Terry fine sandy loam, undulating	Moderate: slopes are 2 to 8 percent.	Slight	Slight	Slight.
Terry-Travessilla sandy loams, undulating	Severe: bedrock at a depth of less than 20 inches.	Slight	Slight	Slight.
Teton loam, 8 to 25 percent slopes	Severe: slopes are 8 to 25 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 35 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 35 percent.	Slight where slopes are 8 to 15 percent. Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Teton complex, 25 to 45 percent slopes	Severe: slopes are 25 to 45 percent.	Severe: slopes are 25 to 45 percent.	Severe: slopes are 25 to 45 percent.	Severe: slopes are 25 to 45 percent.
Thedalund loam, undulating	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Thedalund-Clapper complex, hilly	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Thedalund-Cushman loams, undulating	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Thedalund-Fort Collins complex, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Thedalund-McRae loams, dissected	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 35 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 35 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 35 percent.	Slight where slopes are 4 to 15 percent. Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Thedalund-Midway complex, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Thedalund-Nelson complex, rolling	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 15 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight.
Thedalund-Rock outcrop complex, hilly	Severe: slopes are 15 to 35 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Thedalund-Rock outcrop complex, very steep	Severe: slopes are 35 to 90 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are 35 to 90 percent.	Severe: slopes are 35 to 90 percent.	Severe: slopes are 35 to 90 percent.
Thedalund-Travessilla loams, rolling	Severe: bedrock at a depth of less than 20 inches.	Slight	Slight	Slight.
Thedalund-Wibaux loams, undulating	Severe: bedrock at a depth of less than 20 inches.	Moderate: coarse fragments on surface.	Moderate: coarse fragments on surface.	Moderate: coarse fragments on surface.

TABLE 3.—*Limitations of the soils for selected recreational uses—Continued*

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Thedalund-Wibaux complex, rolling .....	Severe: slopes are 8 to 15 percent; bedrock at a depth of less than 20 inches.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: coarse fragments on surface.
Thedalund-Wibaux stony loams, hilly .....	Severe: slopes are 25 to 40 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are 25 to 40 percent.	Severe: slopes are 25 to 40 percent.	Severe: slopes are 25 to 40 percent.
Thedalund-Wibaux complex, very steep .....	Severe: slopes are 35 to 90 percent.	Severe: slopes are 35 to 90 percent.	Severe: slopes are 35 to 90 percent.	Severe: slopes are 35 to 90 percent.
Thurlow silty clay loam, 0 to 1 percent slopes .....	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Thurlow silty clay loam, 1 to 4 percent slopes .....	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Thurlow silty clay loam, 4 to 8 percent slopes .....	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Thurlow-Midway silty clay loams, 4 to 15 percent slopes .....	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Toluca-Harvey complex, undulating .....	Moderate: slopes are 2 to 8 percent.	Slight .....	Slight .....	Slight.
Travessilla-Rock outcrop complex, rolling .....	Severe: bedrock at a depth of less than 20 inches.	Moderate: coarse fragments on surface.	Moderate: coarse fragments on surface.	Moderate: coarse fragments on surface.
Travessilla-Thedalund loams, rolling .....	Severe: slopes are 8 to 15 percent; bedrock at a depth of less than 20 inches.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Tullock loamy fine sand, rolling .....	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 15 percent.	Moderate: loamy fine sand surface layer.	Moderate: loamy fine sand surface layer.	Moderate: loamy fine sand surface layer.
Twin Creek loam, 2 to 4 percent slopes .....	Moderate: slopes are 2 to 4 percent.	Slight .....	Slight .....	Slight.
Twin Creek loam, 4 to 8 percent slopes .....	Moderate: slopes are 4 to 8 percent.	Slight .....	Slight .....	Slight.
Twin Creek loam, 8 to 15 percent slopes .....	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Twin Creek-Korchea complex, 2 to 8 percent slopes .....	Moderate: slopes are 2 to 8 percent.	Slight .....	Slight .....	Slight.
Vananda clay, 0 to 1 percent slopes .....	Severe: clay surface layer; very slow permeability.	Severe: clay surface layer; very slow permeability.	Severe: clay surface layer.	Severe: clay surface layer.
Vananda clay, 1 to 8 percent slopes .....	Severe: clay surface layer; very slow permeability.	Severe: clay surface layer; very slow permeability.	Severe: clay surface layer.	Severe: clay surface layer.
Vebar fine sandy loam, undulating .....	Moderate: slopes are 4 to 8 percent.	Slight .....	Slight .....	Slight.
Vebar fine sandy loam, rolling .....	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.



TABLE 3.—*Limitations of the soils for selected recreational uses—Continued*

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Vebar-Castner complex, undulating	Severe: bedrock at a depth of less than 20 inches.	Moderate: coarse fragments on surface.	Moderate: coarse fragments on surface.	Moderate: coarse fragments on surface.
Vebar-Castner complex, rolling	Severe: slopes are 8 to 15 percent; bedrock at a depth of less than 20 inches.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: coarse fragments on surface.
Vebar complex, rolling	Severe: slopes are 8 to 25 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 25 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 25 percent.	Slight where slopes are 8 to 15 percent. Moderate where slopes are 15 to 25 percent.
Wages loam, 0 to 2 percent slopes	Slight	Slight	Slight	Slight.
Wages loam, 2 to 4 percent slopes	Moderate: slopes are 2 to 4 percent.	Slight	Slight	Slight.
Wages loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Wayden silty clay loam, rolling	Severe: slopes are 8 to 15 percent; bedrock at a depth of less than 20 inches.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Wayden silty clay loam, hilly	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes of 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Wayden-Arnegard complex, hilly	Severe: slopes are 15 to 75 percent.	Severe: slopes are 15 to 75 percent.	Severe: slopes are 15 to 75 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are 25 to 75 percent.
Wayden-Grail complex, hilly	Severe: slopes are 8 to 35 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 35 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 35 percent.	Moderate: silty clay loam surface layer. Severe where slopes are more than 25 percent.
Wayden-Judith silty clay loams, hilly	Severe: slopes are 8 to 35 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 35 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 35 percent.	Moderate: silty clay loam surface layer. Severe where slopes are more than 25 percent.
Wayden-Regent silty clay loams, hilly	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate: silty clay loam surface layer. Severe where slopes are more than 25 percent.
Wayden-Savage silty clay loams, rolling	Severe: slopes are 8 to 20 percent; bedrock at a depth of less than 20 inches.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 20 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 20 percent.	Moderate: silty clay loam surface layer.
Wayden-Rock outcrop complex, rolling	Severe: slopes are 8 to 15 percent; bedrock at a depth of less than 20 inches.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Wayden-Rock outcrop complex, hilly	Severe: slopes are 15 to 35 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Wayden-Shale outcrop complex, very steep	Severe: slopes are 25 to 90 percent.	Severe: slopes are 25 to 90 percent.	Severe: slopes are 25 to 90 percent.	Severe: slopes are 25 to 90 percent.
Wayden complex, hilly	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.

TABLE 3.—*Limitations of the soils for selected recreational uses—Continued*

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Wibaux loam, hilly .....	Severe: slopes are 15 to 35 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Wibaux-Spearman complex, rolling .....	Severe: slopes are 8 to 15 percent; bedrock at a depth of less than 20 inches.	Moderate: slopes are 8 to 15 percent; coarse fragments on surface.	Moderate: slopes are 8 to 15 percent; coarse fragments on surface.	Moderate: coarse fragments on surface.
Windham cobbly loam, 15 to 35 percent slopes .....	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Windham complex, 15 to 35 percent slopes .....	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Windham-Arnegard complex, 15 to 35 percent slopes .....	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Windham-Norbert complex, 15 to 50 percent slopes .....	Severe: slopes are 15 to 50 percent.	Severe: slopes are 15 to 50 percent.	Severe: slopes are 15 to 50 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are 25 to 50 percent.
Windham-Wayden complex, 15 to 35 percent slopes .....	Severe: slopes are 15 to 35 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are 25 to 35 percent.
Windham-Lap association, very steep .....	Severe: slopes are 15 to 75 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are 15 to 75 percent.	Severe: slopes are 15 to 75 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are 25 to 75 percent.
Winnett complex, undulating .....	Severe: very slow permeability.	Severe: very slow permeability.	Severe: clay surface layer.	Severe: clay surface layer.
Xavier silty clay loam, gently undulating .....	Moderate: slopes are 2 to 4 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Xavier silty clay loam, undulating .....	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Xavier silty clay loam, rolling .....	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Xavier-Shaak complex, undulating .....	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Xavier-Shaak complex, rolling .....	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.

### Use of the Soils for Wildlife<sup>3</sup>

Wildlife is a product of the land. The abundance of a species is directly related to the extent and diversity of its habitat. The relationship of wildlife to soils is more aptly expressed as a soil-vegetation-wildlife relationship, inasmuch as species of wildlife are more readily associated with the plant communities that

grow on their habitat than to specific soils alone. Productive, well-managed soils generally support vigorous wildlife populations; infertile, poorly managed soils usually support a sparse population. Together, plants and animals make up a natural community that is governed by many environmental factors, of which soil is but a part.

Coniferous forest, range, dry and irrigated farmland, riparian woodlands, streams and rivers, ponds, and reservoirs provide a variety of wildlife habitat in Big Horn County.

<sup>3</sup> By RONALD F. BATCHELOR, biologist, Soil Conservation Service.



Irrigated farming has made possible the successful, although limited, introduction of the ring-necked pheasant, particularly in the bottom lands along the Little Big Horn and Big Horn Rivers. This was possible because of land-use pattern that included small grain, annual weeds, and adequate cover. The pheasant population is limited, however, by the same farm practices that fostered it. In recent years, fewer acres of small grain have been grown and more pasture has been used, resulting in a decline in the number of pheasants.

Gray, or Hungarian partridge are also associated with cropland and grassland in the Area. The gray partridge population fluctuates, building to a fairly high number and then declining because of weather, disease, or changes in habitat.

Sharp-tailed grouse occur throughout much of the grassland in the Area, especially during winter in the Little Big Horn Valley where grainfields, brushy cover, and an abundance of fruit-bearing shrubs, including cherry, rose, snowberry, sumac, and buffaloberry, provide excellent habitat. Important management practices beneficial to sharp-tailed grouse include proper grazing to insure that sufficient vegetation remains for nesting and the protection of woody vegetation in draws and fencerows, which provide both food and shelter.

Sage grouse inhabit areas of range that have a cover of sagebrush. Blue grouse, forest-dwelling birds, occupy foothills and mountains covered with mixed conifers.

Pronghorn antelope share the range of the Area with cattle. The potential for maintaining herds of antelope in the Area is dependent upon the proper management of range. If the range is overgrazed, competition for food between cattle and antelope becomes serious; on properly managed range, however, competition seldom exists. Antelope utilize forbs and browse species that cattle do not commonly eat unless forced to do so because of overgrazing.

Both mule deer and white-tailed deer live in the Area. White-tailed deer generally inhabit the lowlands, the valleys and islands of the Little Big Horn and Big Horn Rivers, brushy bottoms, and lower foothills adjacent to farmland. Mule deer range throughout the Pryor and Big Horn Mountains and along the breaks, brushy bottoms, and timbered slopes of the sedimentary plains.

A few Rocky Mountain elk inhabit the Big Horn Mountains at the extreme southern boundary of the Area.

The Yellowtail and Tongue River Reservoirs, as well as numerous ponds, provide habitat for waterfowl during migrations in spring and fall. From these lakes and ponds, ducks and geese fly to nearby fields to feed on waste grains.

Sport fishing for rainbow trout, walleye, and northern pike is provided by Yellowtail and Tongue River Reservoirs. Brown trout are common in the upper reaches of the Little Big Horn River and Pass and Lodgegrass Creeks. Trout fishing is excellent in the upper 5 miles of the Big Horn River. Sedimentation from irrigation waste water and tributary streams

below St. Xavier limit fish populations to essentially nongame species.

Beaver and muskrat inhabit the major watercourses. Cottontail rabbits, raccoon, badger, ground squirrels, coyotes, and other small mammals can be found throughout the Area.

The abundance of game and nongame species could be increased by applying conservation practices that improve habitat. Among these are the development of oddly or irregularly shaped areas in and adjacent to farmland, protection of such areas from fire and grazing, and the establishment of woody vegetation that provides winter cover. Wildlife may also be enhanced through increased application of such commonly employed conservation practices as proper grazing use, a planned grazing system, stripcropping, field windbreaks, and the construction of ponds.

### Engineering Uses of the Soils<sup>4</sup>

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among the properties of soils that are highly important in engineering are permeability, strength, compaction characteristics, soil drainage condition, shrink-swell potential, grain-size distribution, plasticity, and soil reaction. Also important are depth to the water table, depth to bedrock, and soil slope. These properties, in various degrees and combinations, affect the construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate the performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting the performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 4 and 5, which show, respectively, several

<sup>4</sup> F. WODNIK, Soil Conservation Service, helped prepare the tables in this section.

TABLE 4.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in the series is made up of two or more kinds of soil. The instructions for referring to other series in the first column of this

Soil series and map symbols	Depth to bedrock and gravel	Depth from surface	Dominant USDA texture	Classification	
				Unified	AASHTO
<i>Inches</i>	<i>Inches</i>				
*Abac: Aa, AB, AC, AD For properties of Bitton soil in AC, refer to Bitton series. Rock outcrop part of AD is too variable to rate.	6-20 (shale or sandstone)	0-19 19	Loam, gravelly loam Shale.	GM or ML	A-4
*Absarokee: Ae, Af, Ag, AH, Ak, AL, AM For properties of Castner soils in Ak and AL and of Armington soil in AM, refer to Castner and Armington series, respectively.	20-40 (hard sandstone or shale)	0-31 31	Silty clay loam, clay Shale or sandstone.	CL	A-6
*Absher: An For properties of Nobe soil, refer to Nobe series.	>60	0-62	Clay, clay loam, silty clay loam.	CL	A-6 or A-7
*Adel: AO For properties of Mayflower soil, refer to Mayflower series.	40-60 (shale)	0-14 14-40 40	Loam Clay loam Clay shale.	ML CL	A-4 A-6
Adger: Ap	>60	0-18 18-60	Clay Silty clay	CL CL	A-7 A-7
Alice: Ar	>60	0-65	Sandy loam, loamy sand	SM	A-2 or A-4
*Allentine: Asa, Asb, Asc, Asd For properties of Bone soils in Asc and Asd, refer to Bone series.	>60	0-60	Clay	CL or CH	A-7
*Alluvial land: ATa, ATb, ATc. Too variable to rate.					
*Amherst: Au, AVa, AVb, AVc, AVd For properties of Maginnis soil in AVd, refer to Maginnis series.	10-20 (hard shale)	0-19 19	Channery silty clay loam, clay. Shale.	CL	A-7
Armington: AWA, AWb	>60	0-60	Clay	CH	A-7
Arnegard: Axa, Axb, Axc	>60	0-14 14-61	Loam Clay loam	ML CL	A-4 A-7
*Arvada: Ayd, Aye For properties of Bone soil in Aye, refer to Bone series.	>60	0-60	Silty clay and clay	CL or CH	A-7
Ascalon: Az	>60	0-7 7-27 27-65	Sandy loam Sandy clay loam Sandy loam	SM SC SM	A-2 or A-4 A-6 A-2 or A-4
Babb: BA, BB	40->60 (bedrock)	0-20 20-60	Loam and clay loam Channery loam, very channery loam.	CL or ML GM	A-4 A-2, A-4, or A-1
*Beauvais: Bc, Bd, Be, Bf For properties of Gilt Edge soil in Bf, refer to Gilt Edge series.	>60	0-60	Silty clay loam	CL	A-6
*Belfield: Bg, Bh, Bk, Bm, Bn, Bo For properties of Adger soils in Bm, Bn, and Bo, refer to Adger series.		0-60	Silty clay loam, silty clay	CL	A-7
Benteen: Bp, Br	20-40 (limestone)	0-22 22-29 29	Loam and clay loam Channery loam Limestone.	CL CL	A-6 A-6
Bew: Bs, Bt	>60	0-60	Clay	CL or CH	A-7
Bitton: BU, BV	>60	0-11 11-64	Gravelly loam Very gravelly loam	ML GM	A-4 A-1, A-2
Bone: Bw	>60	0-62	Clay and silty clay	CL or CH	A-7



*significant in engineering*

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the table. The symbol > means more than; the symbol < means less than]

Per- centage larger than 3 inches	Percentage passing sieve—				Permea- bility	Available water capacity	Reaction	Shrink- swell potential	Frost- action potential	Corrosivity	
	No. 4	No. 10	No. 40	No. 200						Untreated steel	Concrete
10	65-85	65-85	50-65	40-60	<i>Inches per hour</i> 0.6-2.0	<i>Inches per inch of soil</i> 0.10-0.15	pH 7.4-7.8	Low	Moderate	High	Low.
	100	100	95-100	80-95	0.2-0.6	0.12-0.18	6.6-7.3	Moderate or high.	Moderate or high.	High	Low.
	100	100	90-100	75-85	<0.06	0.12-0.18	7.9-8.4	High	Moderate	High	Low.
	100	100	85-95	60-70	0.6-2.0	0.16-0.18	6.6-7.3	Low	High	High	Low.
	100	100	90-100	75-85	0.6-2.0	0.17-0.20	6.6-7.8	Moderate	Moderate	High	Low.
	100	100	90-100	85-95	0.06-0.2	0.12-0.18	7.9-8.4	High	Moderate	High	Low.
	100	100	95-100	90-95	0.06-0.2	0.12-0.18	8.5-9.0	High	Moderate	High	Low.
	100	100	60-65	30-40	2.0-6.0	0.10-0.16	7.4-7.8	Low	Moderate	High	Low.
	100	100	95-100	85-95	<0.06	0.12-0.18	7.9-8.4	High	Moderate	High	Low.
0-10	65-90	60-85	55-85	50-80	0.6-2.0	0.12-0.17	7.4-7.8	Moderate or high.	Moderate or high.	High	Low.
	100	95-100	95-100	85-95	<0.06	0.13-0.17	7.4-8.4	High	Moderate	High	Low.
	100	100	85-95	60-75	0.6-2.0	0.14-0.20	6.6-7.3	Low	High	High	Low.
	100	100	90-95	70-80	0.6-2.0	0.14-0.18	7.4-7.8	Moderate	High	High	Low.
	100	100	95-100	90-95	<0.6	0.12-0.18	7.8-9.5	High	Moderate	High	Low.
	90-100	85-100	60-70	30-40	2.0-6.0	0.12-0.16	7.4-7.8	Low	Moderate	High	Low.
	90-100	85-100	80-90	35-50	0.6-2.0	0.12-0.18	7.4-7.8	Moderate	Moderate	High	Low.
	90-100	85-100	60-70	30-40	2.0-6.0	0.12-0.16	7.4-7.8	Low	Moderate	High	Low.
	80-90	75-90	70-85	50-65	0.6-2.0	0.10-0.16	6.6-7.3	Moderate	Moderate	High	Low.
	40-75	35-70	30-65	20-50	2.0-6.0	0.06-0.12	7.4-7.9	Low or moder- ate.	Low or moder- ate.	High	Low.
	100	100	90-100	85-95	0.2-0.6	0.14-0.20	6.6-8.4	Moderate	High	High	Low.
	100	100	95-100	85-95	0.2-0.6	0.14-0.20	7.4-8.4	Moderate	High	High	Low.
0-10 10-20	75-100	70-90	65-85	50-70	0.6-2.0	0.12-0.18	6.6-7.3	Moderate	High	High	Low.
	75-90	70-85	60-75	55-65	0.6-2.0	0.10-0.14	7.4-7.8	Moderate	High	High	Low.
	100	100	95-100	90-95	0.06-0.2	0.12-0.18	7.4-8.4	High	Moderate	High	Moderate.
5-10 10-30	85-100	80-90	60-75	55-65	2.0-6.0	0.12-0.17	7.4-7.8	Low	Moderate	High	Low.
	50-70	30-55	25-50	15-35	6.0-20.0	0.07-0.10	7.4-7.8	Low	Low	High	Low.
	100	100	90-100	75-95	<0.06	0.12-0.18	7.9-9.0	High	Moderate	High	Moderate.

TABLE 4.—*Estimated soil properties*

Soil series and map symbols	Depth to bedrock and gravel	Depth from surface	Dominant USDA texture	Classification	
				Unified	AASHTO
<i>Inches</i> *Castner: CA, CB, CC, CD For properties of Reeder soils in CA and CB and of Vebar soil in CD, refer to Reeder and Vebar series, respectively. Rock outcrop part of CC is too variable to rate.	6-20 (shale and sandstone)	<i>Inches</i> 0-12 12	Channery sandy loam Sandy shale.	SM	A-2, A-4
Cherry: Ce	>60	0-60	Silty clay loam	CL	A-7
Chugter: Cf, CG	>60	0-63	Loam	ML	A-4 or A-6
*Clapper: CH, CK For properties of Harvey soil in CH and of Midway soil in CK, refer to Harvey and Midway series, respectively.	>60	0-16 16-60	Gravelly loam Very gravelly loam	GM or ML GM	A-4 A-2 or A-1
*Colby: Cm, Cn, Co, Cp, Cr, Cs, Ct, CU, Cv, CW, CX, CY. For properties of Beauvais soils in Cs and Ct, of Clapper soil in CU, of Keiser soil in Cv, and of Midway soil in CW, refer to Beauvais, Clapper, Keiser, and Midway series, respectively.	>60	0-60	Silty clay loam, silt loam	CL	A-6
Cushman: Cz	20-40 (shale or sandstone)	0-10 10-35 35	Clay loam Loam Shale.	CL CL	A-6 or A-7 A-6
*Danvers: Da, Db, Dc, Dd, De, Df, Dg For properties of Judith soils in De, Df, and Dg, refer to Judith series.	>60	0-43 43-65	Silty clay loam Loam	CL ML	A-6 or A-7 A-4 or A-6
Darret Mapped only with Reeder soils.	20-40 (shale or sandstone)	0-7 7-35 35	Silt loam Silty clay, silty clay loam Shale or sandstone.	ML CL	A-4 A-7
*Dast: DHa, DHb, DHc, DHd, Dk For properties of Parshall soil in Dk, refer to Parshall series.	20-40 (sandstone)	0-26 26	Sandy loam Sandstone.	SM	A-4 or A-2
*Doney: DMA, DMb, Dn, DOa, DOb, DOc, DOd, DOe. For properties of Reeder soil in Dn, of Ringling soils in DOa, DOb, and DOc, and of Wayden soil in DOe, refer to Reeder, Ringling, and Wayden series, respectively. Rock outcrop part of DOd is too variable to rate.	20-40 (shale or sandstone)	0-21 21	Loam Sandstone or siltstone.	ML or GM	A-4 or A-2
*Duncom: Dp, DR, DS, DT For properties of Tarrete soils in DS and DT, refer to Tarrete series.	10-20 (limestone)	0-18 18	Gravelly loam Dolomite.	GM	A-2 or A-1
Eltzac: Ec, Ed, EH	20-40 (shale)	0-24 24-34 34	Clay Clay Shale.	CH CH	A-7 A-7
*Farnuf: Fa, Fb, Fc, FD For properties of Doney soil in FD, refer to Doney series.	>60	0-16 16-24 24-63	Loam Clay loam Loam	ML-CL CL ML-CL	A-4 A-6 or A-7 A-4
Fergus: Fe, Ff, Fg	>60	0-14 14-31 31-62	Silt loam Silty clay loam Silt loam	ML-CL CL ML-CL	A-4 A-7 A-4
Fort Collins: Fh, Fk, Fm, Fn	>60	0-12 12-65	Clay loam Loam	CL ML	A-6 A-4



significant in engineering—Continued

Per-centage larger than 3 inches	Percentage passing sieve—				Permea-bility	Available water capacity	Reaction	Shrink-swell potential	Frost-action potential	Corrosivity	
	No. 4	No. 10	No. 40	No. 200						Untreated steel	Concrete
10-50	95-100	95-100	60-70	30-40	<i>Inches per hour</i> 0.6-2.0	<i>Inches per inch of soil</i> 0.08-0.13	<i>pH</i> 7.4-7.8	Low	Moderate	High	Low.
	100	100	95-100	85-95	0.2-0.6	0.16-0.20	7.9-8.4	Moderate	High	High	Low.
	95-100	95-100	80-90	60-75	0.6-2.0	0.14-0.20	7.4-8.4	Low	High	High	Low.
	65-90	60-70	50-65	40-55	0.6-2.0	0.10-0.16	7.4-8.4	Low	Moderate or high.	High	Low.
10-30	50-70	35-50	30-50	20-35	0.6-2.0	0.07-0.10	7.9-8.4	Low	Low	High	Low.
	100	100	95-100	85-95	0.6-2.0	0.16-0.20	7.4-7.8	Moderate	High	High	Low.
	100	100	90-100	70-80	0.6-2.0	0.12-0.18	7.4-7.8	Moderate	High	High	Low.
	100	100	90-100	60-70	0.6-2.0	0.15-0.20	7.4-7.8	Moderate	High	High	Low.
0-30	85-100	85-100	80-100	75-95	0.6-2.0	0.14-0.20	7.4-7.8	Moderate	High	High	Low.
0-30	85-100	85-100	75-95	50-75	0.6-2.0	0.14-0.20	7.4-7.8	Low	High	High	Low.
	85-100	75-100	70-85	60-75	0.6-2.0	0.16-0.20	6.6-7.3	Low	High	High	Low.
	85-100	75-100	75-100	65-95	0.6-2.0	0.12-0.16	7.4-7.8	High or moderate.	Moderate	High	Low.
	100	100	60-70	30-40	2.0-6.0	0.10-0.16	6.6-7.8	Low	Moderate	High	Low.
	60-95	50-90	40-75	30-50	0.6-2.0	0.11-0.16	7.4-7.8	Low	High or moderate.	High	Low.
15-45	55-65	40-60	35-50	20-35	0.6-2.0	0.07-0.10	7.4-8.4	Low	Moderate	High	Low.
	100	100	100	75-95	<0.06	0.12-0.18	7.4-7.8	High	Moderate	High	Low.
	70-95	60-90	60-90	60-80	<0.06	0.11-0.14	7.9-8.4	High	Moderate	High	Moderate.
	100	100	85-95	60-75	0.6-2.0	0.15-0.20	7.4-7.9	Low	High	High	Low.
	100	100	90-100	70-80	0.6-2.0	0.14-0.18	7.9-8.4	Moderate	High	High	Low.
	85-100	75-100	60-95	50-75	0.6-2.0	0.15-0.20	7.9-8.4	Low	High	High	Low.
	100	100	95-100	75-85	0.6-2.0	0.18-0.22	6.6-7.3	Low	High	High	Low.
	100	100	95-100	85-95	0.2-0.6	0.15-0.20	7.4-8.4	Moderate	High	High	Low.
	100	100	90-95	70-85	0.6-2.0	0.17-0.20	7.4-8.4	Low	High	High	Low.
	90-100	85-100	80-95	70-80	0.6-2.0	0.14-0.18	7.4-7.8	Moderate	High	High	Low.
	100	100	85-95	60-75	0.6-2.0	0.16-0.20	7.4-8.4	Low	High	High	Low.

TABLE 4.—Estimated soil properties

Soil series and map symbols	Depth to bedrock and gravel	Depth from surface	Dominant USDA texture	Classification	
				Unified	AASHTO
	<i>Inches</i>	<i>Inches</i>			
*Frazer: Fo, Fr, Fs, FT..... For properties of Korchea soil in FT, refer to Korchea series.	>60	0-38 38-65	Silty clay loam..... Silty clay loam, silt loam (stratified).	CL CL	A-7 A-6
*Gilt Edge: Gc, Gd, Ge, Gf..... For properties of Bone soils in Ge and Gf, refer to Bone series.	>60	0-3 3-27 27-60	Loam, silt loam..... Clay, silty clay..... Silty clay loam.....	ML-CL CH CL	A-4 A-7 A-7
Glenberg: Gg, Gh, Gk, Gm.....	>60	0-60	Fine sandy loam.....	SM	A-2 or A-4
Grail: Gn, Go, Gr, GS, Gt.....		0-8 8-65	Clay loam..... Silty clay.....	CL CL or CH	A-6 or A-7 A-7
*Hanson: HA, HB..... For properties of Babb soil in HB, refer to Babb series.	>60	0-108	Very gravelly loam.....	GM or SM	A-2 or A-1
Harvey: Hca, Hcb, Hcc, Hd, He.....	>60	0-31 31-43 43-50	Loam..... Gravelly loam..... Very gravelly loam.....	CL GM GM	A-6 A-4 or A-6 A-2 or A-1
*Haverson: Hfa, Hfb, Hfc, HGa, HGb, HGe, Hh, HK..... For properties of Hysham soil in Hfh, of Glenberg soil in HGa, and of Lohmiller soils in HGb, HGe, and Hh, refer to Hysham, Glenberg, and Lohmiller series, respectively.	>60	0-33 33-60	Loam..... Sandy loam.....	ML-CL SM	A-4 A-4 or A-2
Hfd, Hfe, Hff, Hfh.....	>60	0-12 12-60	Silty clay loam or silty clay..... Loam and thin strata of silty clay loam and silty clay.	CL ML-CL, CL	A-6 or A-7 A-4
*Heldt: Hla, Hlb, Hlc, Hld, Hle, Hlf, Hlg..... For properties of Hysham soils in Hlf and Hlg, refer to Hysham series.	>60	0-60	Silty clay loam.....	CL	A-7
Hesper: Hma, Hmb, Hmc.....	>40 (sand and gravel)	0-49 49-60	Silty clay, silty clay loam..... Very gravelly sand.....	CL GW or GP	A-7 A-1
*Hydro: Hna, Hnb, Hnc, Hnd, Hne, Hnf, Hng, Hnh, Hnk..... For properties of Allentine soils in Hng and Hnh and of Gilt Edge soil in Hnk, refer to Allentine and Gilt Edge series, respectively.	>60	0-39 39-65	Silty clay..... Stratified silt loam, very fine sandy loam.	CL ML-CL	A-7 A-4
*Hysham: Ho, Hp, Hr, HS, HT..... For properties of Midway soil in HS and of Lohmiller soil in HT, refer to Midway and Lohmiller series, respectively.	>60	0-63	Silty clay loam.....	CL	A-6 or A-7
*Judith: Jc, Jd, Je, Jh, Jk..... For properties of Windham soils in Jh and Jk, refer to Windham series.	>60	0-25 25-60	Loam and clay loam..... Very gravelly loam.....	CL GM or GP-GM	A-6 A-2
*Keiser: Kc, Kd, Ke, Kf..... For properties of Colby soil in Kf, refer to Colby series.	>60	0-21 21-60	Silty clay loam..... Silt loam.....	CL ML	A-7 A-4
Kim: Kg.....	>60	0-33 33-65	Loam..... Silt loam.....	ML ML	A-4 A-4
*Korchea: Kh, Kk, Km, Kn, Ko, Kp, KR..... For properties of Frazer soil in KR, refer to Frazer series.	>60	0-72	Loam, silt loam.....	ML	A-4
Kyle: Ks, Kt, Ku, KV, Kw.....	>60	0-62	Clay.....	CH	A-7



significant in engineering—Continued

Per-centage larger than 3 inches	Percentage passing sieve—				Permea-bility	Available water capacity	Reaction	Shrink-swell potential	Frost-action potential	Corrosivity	
	No. 4	No. 10	No. 40	No. 200						Untreated steel	Concrete
					<i>Inches per hour</i>	<i>Inches per inch of soil</i>	<i>pH</i>				
	100	100	95-100	85-95	0.06-0.2	0.14-0.20	7.4-7.8	Moderate	High	High	Low.
	100	100	90-100	80-95	0.06-0.2	0.14-0.20	7.4-8.4	Moderate	High	High	Low.
	100	100	90-95	60-90	0.6-2.0	0.18-0.22	7.9-8.4	Low	High	High	Low.
	100	100	90-100	75-95	0.06-0.2	0.12-0.18	7.9-8.4	High	Moderate	High	Low.
	100	100	95-100	85-95	0.2-0.6	0.14-0.20	8.5-9.0	Moderate	High	High	Low.
	100	100	60-70	30-40	2.0-6.0	0.11-0.14	7.4-8.4	Low	Moderate	High	Low.
	100	100	90-100	70-80	0.6-2.0	0.12-0.18	6.6-7.3	Moderate	High	High	Low.
	100	100	95-100	90-95	0.2-0.6	0.12-0.18	7.4-7.8	High	Moderate	High	Low.
25-35	40-70	35-65	30-45	20-35	0.6-2.0	0.09-0.11	6.6-8.4	Low	Moderate or low.	High	Low.
	80-100	70-100	65-95	50-70	0.6-2.0	0.15-0.20	7.4-7.8	Moderate	High	High	Low.
15-30	70-80	65-75	60-70	40-50	2.0-6.0	0.11-0.14	7.4-7.8	Low	Moderate	High	Low.
	50-60	35-45	30-40	20-30	2.0-6.0	0.09-0.11	7.4-7.8	Low	Low	High	Low.
	100	100	85-95	60-75	0.6-2.0	0.14-0.20	7.4-8.4	Low	High	High	Low.
	100	100	60-70	30-40	2.0-6.0	0.13-0.16	7.4-8.4	Low	High	High	Low.
	100	100	95-100	85-95	0.2-0.6	0.16-0.19	7.4-8.4	Moderate	High	High	Low.
	100	100	85-95	65-80	0.6-2.0	0.15-0.18	7.4-8.4	Low	High	High	Low.
	95-100	90-100	90-100	85-95	0.06-0.2	0.15-0.20	7.4-8.6	Moderate	High	High	Low.
	100	100	95-100	75-95	0.2-0.6	0.13-0.18	7.4-8.4	Moderate or high.	Moderate or high.	High	Low.
	35-50	20-35	10-25	0-15	>20.0	<0.04	7.4-8.4	Low	Low	High	Low.
	100	100	90-100	90-95	0.06-0.2	0.13-0.18	7.9-8.4	High	Moderate	High	Low.
	100	100	85-100	50-90	0.6-2.0	0.14-0.22	7.9-8.4	Low	High	High	Low.
	100	100	95-100	85-95	0.06-0.2	0.14-0.20	8.5-9.0	Moderate	High	High	Moderate.
0-30	100	85-100	75-95	55-75	0.6-2.0	0.14-0.20	7.9-8.4	Low or moderate.	High	High	Low.
0-10	40-65	35-60	25-50	10-30	2.0-6.0	0.08-0.10	7.9-8.4	Low	Low	High	Low.
	100	90-100	90-100	85-95	0.2-0.6	0.16-0.18	7.4-7.8	Moderate	High	High	Low.
	100	90-100	90-100	70-90	0.6-2.0	0.18-0.22	7.4-8.4	Low	High	High	Low.
	100	100	85-95	60-75	0.6-2.0	0.15-0.20	7.4-8.4	Low	High	High	Low.
	100	100	90-100	70-85	0.6-2.0	0.18-0.22	7.4-8.4	Low	High	High	Low.
	100	100	85-95	65-75	0.6-2.0	0.16-0.20	7.4-8.4	Low	High	High	Low.
0-25	70-100	65-100	60-100	50-95	<0.06	0.12-0.18	7.9-8.4	High	Moderate	High	Moderate.

TABLE 4.—*Estimated soil properties*

Soil series and map symbols	Depth to bedrock and gravel	Depth from surface	Dominant USDA texture	Classification	
				Unified	AASHTO
La Fonda: La .....	<i>Inches</i> >60	<i>Inches</i> 0-60	Loam .....	ML	A-4
*Lap: LCa, LCb, LCC, LCD .....	10-20 (limestone)	0-19 19	Very channery loam .....	GM	A-1
For properties of Trulon soil in LCa and of Armington soil in LCD, refer to Trulon and Armington series, respectively.			Limestone.		
*Lavina: LD .....	10-20 (hard shale)	0-14 14	Loam, clay loam .....	CL	A-6
For properties of Travessilla soil, refer to Travessilla series.			Shale and sandstone.		
*Lennep: Lea, Leb, Lec, Led .....	>60	0-8 8-73	Loam, silty clay loam .....	CL	A-6
For properties of Adger soils in Lec and Led, refer to Adger series.			Silty clay, clay .....	CL or CH	A-7
*Lismas: LF, LG, LH, LK, LM, LN .....	10-20 (shale)	0-18 18	Clay .....	CL or CH	A-7
For properties of Vananda soil in LN, refer to Vananda series. Shale out-crop parts of LK and LM are too variable to rate.			Shale.		
*Lohmiller: Lo, Lp, Lr, Ls, Lt, Lu, LV .....	>60	0-63	Silty clay loam, silty clay .....	CL	A-7
For properties of Midway soil in LV, refer to Midway series.					
Macar: Ma .....	>60	0-61	Loam, clay loam .....	CL or ML	A-4
*Maginnis: MB, MC .....	8-20 (shale)	0-16 16	Channery silty clay, very channery clay.	GC	A-2 or A-7
For properties of Windham soil in MC, refer to Windham series. Shale out-crop part of MB is too variable to rate.			Shale and sandstone.		
Marias: Md, Me, Mf, Mg .....	>60	0-60	Clay .....	CL or CH	A-7
*Maschetah: MH, MK .....	>60	0-65	Silty clay loam, silt loam .....	CL	A-6
For properties of Norbert soil in MK, refer to Norbert series.					
Mayflower: Mm, MN .....	20-40 (clay shale and sandstone)	0-34 34	Silty clay, silty clay loam .....	CL	A-7
			Shale and sandstone.		
McKenzie: Mo .....	>60	0-60	Clay .....	CH	A-7
McRae: Mp, Mr, Ms, Mt .....	>60	0-63	Loam .....	ML	A-4
*Midway: Mu, MVa, MVb, MVc, MVD, MVe, MVf, MVg .....	10-20 (shale)	0-11 11	Silty clay loam .....	CL	A-7
For properties of Lismas soils in MVc and MVD, of Thedalund soils in MVe and MVf, and of Thurlow soil in MVg, refer to Lismas, Thedalund, and Thurlow series, respectively.			Shale.		
Morton: Mw .....	20-40 (shale and sandstone)	0-5 5-38 38	Silt loam .....	ML	A-4
			Silty clay loam .....	CL	A-6
			Shale and sandstone.		
*Nelson: Nd, Ne, NF .....	20-40 (sandstone)	0-29 29	Sandy loam .....	SM	A-2
For properties of Alice soil in Ne and of Glenberg soil in NF, refer to Alice and Glenberg series, respectively.			Sandstone.		
Neville: Ng .....	40-60 (shale)	0-41 41	Loam .....	CL or ML	A-6 or A-4
			Shale.		



significant in engineering—Continued

Per- centage larger than 3 inches	Percentage passing sieve—				Permea- bility	Available water capacity	Reaction	Shrink- swell potential	Frost- action potential	Corrosivity	
	No. 4	No. 10	No. 40	No. 200						Untreated steel	Concrete
					<i>Inches per hour</i>	<i>Inches per inch of soil</i>	<i>pH</i>				
30-45	75-100	65-100	60-95	50-70	0.6-2.0	0.15-0.20	7.4-8.4	Low	High	High	Low.
	45-60	40-55	35-50	20-35	0.6-2.0	0.08-0.10	6.6-8.4	Low	Moderate	High	Low.
0-10	75-100	65-100	60-80	50-70	0.6-0.2	0.12-0.18	7.4-7.8	Moderate	High	Moderate or high.	Low.
	100	100	85-100	60-95	0.6-2.0	0.14-0.20	7.9-8.4	Moderate	High	High	Low.
	100	100	95-100	75-95	0.06-0.2	0.12-0.17	7.9-8.4	High	Moderate	High	Low.
	90-100	85-95	80-90	75-95	<0.06	0.12-0.18	7.9-8.4	High	Moderate	High	Moderate.
	90-100	90-100	85-100	80-95	0.2-0.6	0.15-0.20	7.9-8.4	Moderate	High	High	Low.
5-15	80-100	75-100	70-90	50-70	0.6-2.0	0.15-0.20	7.4-8.4	Low	High	High	Low.
	30-60	25-55	25-50	20-40	0.2-0.6	0.10-0.12	7.4-7.8	High	Moderate	High	Low.
	100	100	90-100	75-95	<0.06	0.12-0.18	7.9-8.4	High	Moderate	High	Moderate.
	95-100	95-100	90-100	85-95	0.2-0.6	0.14-0.20	7.4-8.4	Moderate	High	High	Low.
	80-100	70-100	60-100	60-95	0.06-0.2	0.15-0.17	7.4-8.4	Moderate or high.	Moderate or high.	High	Low.
0-10	100	100	90-100	75-95	<0.06	0.12-0.18	7.9-9.0	High	Moderate	High	Moderate.
	90-100	80-100	75-95	50-75	0.6-2.0	0.14-0.20	7.4-7.8	Low	High	High	Low.
	80-100	70-95	70-85	60-80	0.06-0.2	0.14-0.18	7.4-8.4	Moderate	High	High	Low.
	100	100	90-100	70-90	0.6-2.0	0.16-0.22	6.6-7.3	Low	High	High	Low.
	95-100	95-100	95-100	85-95	0.6-2.0	0.16-0.20	6.6-7.3	Moderate	High	High	Low.
	85-100	75-100	50-70	30-35	2.0-6.0	0.12-0.16	7.4-8.4	Low	Moderate	High	Low.
	80-100	75-100	70-95	50-75	0.6-2.0	0.16-0.20	7.4-8.4	Low or moder- ate.	High	High	Low.

TABLE 4.—Estimated soil properties

Soil series and map symbols	Depth to bedrock and gravel	Depth from surface	Dominant USDA texture	Classification	
				Unified	AASHTO
Nobe Mapped only with Absher soils.	<i>Inches</i> >60	<i>Inches</i> 0-62	Clay	CL or CH	A-7
*Norbert: NH, NK For properties of Eltsac soil in NH, refer to Eltsac series. Shale outcrop part of NK is too variable to rate.	10-20 (shale)	0-19 19	Clay Shale.	CL or CH	A-7
*Nunn: Nm, Nn, No, Nr, NS For properties of Midway soils in NS, refer to Midway series.	>60	0-8 8-17 17-60	Silty clay loam Silty clay Clay loam, silt loam, sandy clay loam.	CL CL CL	A-6 A-7 A-6
Olney: On	>60	0-25 25-62	Sandy clay loam Sandy loam	SC SM	A-6 A-4 or A-2
Parshall: Pa	>60	0-60	Sandy loam	SM	A-2 or A-4
*Peritsa: Pd, PE, PF For properties of Abac soil in PE, refer to Abac series.	20-40 (shale)	0-31 31	Silty clay loam Shale.	CL	A-6 or A-7
*Pierre: Pg, Ph, Pk, PM, PN For properties of Kyle soil in Pk and of Lismas soils in PM and PN, refer to Kyle and Lismas series, respectively.	20-40 (shale)	0-29 29	Clay Shale.	CL or CH	A-7
*Pultney: PO For properties of Neville soil, refer to Neville series.	20-40 (shale and sandstone)	0-30 30	Loam Shale.	ML	A-4
Quietus: QU	20-40 (limestone or dolomite)	0-11 11-27 27	Loam and clay loam Gravelly loam Dolomite.	CL ML or GM	A-6 A-4 or A-2
Raynesford: Ra	>60	0-30 30-49	Gravelly clay loam Very gravelly loam	CL or GC GM	A-6 A-4, A-2, or A-1
*Reeder: Rda, Rdb, Rdc, REa, REb, REc, REd For properties of Regent soil in REa, of Rentsac soil in REb, and of Darret soils in REc and REd, refer to Regent, Rentsac, and Darret series, respectively.	20-40 (shale and sandstone)	0-30 30	Loam, clay loam Shale and sandstone.	CL	A-6
Regent: Rfa, Rfc, Rfd	20-40 (shale)	0-26 26	Silty clay loam Shale.	CL	A-7
Renohill: Re	20-40 (shale)	0-33 33	Silty clay Shale.	CL	A-7
Rentsac: RH For properties of Doney soil, refer to Doney series.	4-20 (hard shale)	0-8 8	Loam, channery loam Sandy shale.	GM	A-1 or A-2
*Richfield: Rk, Rlc, Rld, Rle, Rlf For properties of Beauvais soils in Rle and Rlf, refer to Beauvais series.	>60	0-26 26-65	Silty clay loam Silt loam and loam	CL ML	A-7 A-4
Ringling Mapped only with Doney soils.	5-20 (hard platy shale)	0-13 13	Very channery loam Shale.	GM	A-2 or A-1
Riverwash: RM. Too variable to rate.					



significant in engineering—Continued

Per-centage larger than 3 inches	Percentage passing sieve—				Permea-bility	Available water capacity	Reaction	Shrink-swell potential	Frost-action potential	Corrosivity	
	No. 4	No. 10	No. 40	No. 200						Untreated steel	Concrete
					<i>Inches per hour</i>	<i>Inches per inch of soil</i>	<i>pH</i>				
	100	100	95-100	75-95	<0.06	0.12-0.18	7.3-9.0	High	Moderate	High	Moderate.
0-5	65-95	55-90	55-90	50-85	<0.06	0.12-0.18	7.8-8.4	High	Moderate	High	Low.
	90-100	85-100	85-100	75-95	0.2-0.6	0.14-0.20	6.6-7.3	Moderate	High	High	Low.
	90-100	85-100	85-100	80-95	0.06-0.2	0.13-0.18	7.9-8.4	High	Moderate	High	Low.
	90-100	85-100	75-95	60-80	0.2-0.6	0.12-0.18	7.9-8.4	Moderate	High	High	Low.
	100	95-100	80-90	40-50	0.6-2.0	0.13-0.15	7.4-7.8	Moderate	Moderate	High	Low.
	100	90-100	60-70	30-40	2.0-6.0	0.10-0.13	7.4-8.4	Low	Moderate	High	Low.
	100	100	60-70	30-40	2.0-6.0	0.10-0.13	6.6-7.3	Low	Moderate	High	Low.
	90-100	90-100	85-100	75-95	0.6-2.0	0.16-0.20	6.6-8.4	Moderate	High	High	Low.
	95-100	90-100	85-100	75-95	<0.06	0.13-0.18	7.9-8.4	High	Moderate	High	Moderate.
	85-100	75-100	65-95	55-75	0.6-2.0	0.14-0.18	7.4-7.8	Low	High	High	Low.
10-25	80-100	75-100	70-95	50-70	0.6-2.0	0.15-0.20	6.1-6.5	Moderate	High	High	Low.
	50-85	45-80	40-75	25-55	0.6-2.0	0.12-0.14	6.6-7.4	Low	Moderate	High	Low.
0-5	65-100	55-95	50-95	35-60	0.2-0.6	0.13-0.15	6.6-7.3	Moderate	Moderate	High	Low.
15-30	45-65	35-60	35-50	20-40	0.2-0.6	0.08-0.10	7.4-8.4	Low	Low	High	Low.
	80-100	75-100	70-95	50-80	0.6-2.0	0.12-0.17	7.4-7.8	Moderate	High	High	Low.
	100	100	95-100	85-90	0.06-0.2	0.16-0.20	7.4-7.8	Moderate	High	High	Low.
	100	100	95-100	85-95	0.06-0.2	0.12-0.15	7.9-8.4	High	Moderate or high.	High	Low.
0-15	45-60	35-55	25-50	20-35	2.0-6.0	0.14-0.16	7.4-7.8	Low	Moderate	High	Low.
	100	100	95-100	85-95	0.2-0.6	0.16-0.20	7.4-7.8	Moderate	High	High	Low.
	100	100	90-100	70-85	0.6-2.0	0.18-0.22	7.4-7.8	Low	High	High	Low.
15-30	40-50	35-45	30-40	20-30	6.0-20.0	0.10-0.12	6.6-7.8	Low	Low	High	Low.

TABLE 4.—Estimated soil properties

Soil series and map symbols	Depth to bedrock and gravel	Depth from surface	Dominant USDA texture	Classification	
				Unified	AASHTO
	<i>Inches</i>	<i>Inches</i>			
*Rock outcrop: RN, RO, RP, RR, RS. For properties of Duncom soil in RN, of Lap soil in RO, of Pultney soil in RP, of Rentsac soil in RR, and of Windham soil in RS, refer to Duncom, Lap, Pultney, Rentsac, and Windham, series, respectively. Rock outcrop is too variable to rate.					
*Rottulee: Rt, Ru, Rv, RW For properties of Abac soils in RW, refer to Abac series.	20-30 (limestone)	0-22 22	Silt loam, gravelly clay loam. Limestone.	ML, GM	A-6
Ryorp: Ry	20-40 (sandstone)	0-34 34	Fine sandy loam, sandy loam. Sandstone.	SM	A-4
Saline land: SA. Too variable to rate.					
*Savage: Sd, Sea, Seb, Sec, Sed, Sef, SF For properties of Wayden soil in Sef and of Frazer soil in SF, refer to Wayden and Frazer series, respectively.	>60	0-61	Silty clay, silty clay loam	CL	A-7
Sawcreek Mapped only with Splitro soils.	20-40 (sandstone)	0-36 36	Sandy loam Sandstone.	SM	A-4 or A-2
*Searing: Sg, SH, SI For properties of Ringling soil in SI, refer to Ringling series.	20-40 (hard play shale and sandstone)	0-30 30	Loam, clay loam Shale and sandstone.	CL	A-6
Shaak: Ska, Skb, Skc, Skd, Ske, SM	>60	0-63	Clay loam, clay	CL	A-7
*Shale outcrop: SOa, SOc, SOd For properties of Midway soil in SOc and of Norbert soil in SOd, refer to Midway and Norbert series, respectively. Shale outcrop is too variable to rate.					
Shonkin: Sp	>60	0-26 26-60	Clay loam, clay Silty clay	CL or CH CL or CH	A-7 A-7
Sofia: Sra, Srb	40-60 (sand and gravel)	0-40 40-60	Silty clay Very gravelly sand	CL or CH GP or GW	A-7 A-1
*Spearfish: SSa, SSb, SSc, SSd For properties of Clapper soil in SSa and of Pultney soils in SSc and SSd, refer to Clapper and Pultney series, respectively. Rock outcrop part of SSb is too variable to rate.	10-20 (shale)	0-15 15	Silty clay loam Shale.	CL	A-6
*Spearman: St, SU For properties of Wibaux soil in SU, refer to Wibaux series.	20-40 (shale)	0-15 15-23 23	Loam and clay loam Channery loam Shale.	CL ML or GM	A-6 A-4
*Splitro: SVa, SVb For properties of Sawcreek soils, refer to Sawcreek series.	10-20 (sandstone)	0-13 13	Sandy loam Sandstone.	SM	A-2, A-4, or A-1
Stormitt: Swa, Swb, SX	>60	0-10 10-60	Loam Very gravelly loam	ML-CL or SM-SC GM	A-4 A-2



significant in engineering—Continued

Per-centage larger than 3 inches	Percentage passing sieve—				Permea-bility	Available water capacity	Reaction	Shrink-swell potential	Frost-action potential	Corrosivity	
	No. 4	No. 10	No. 40	No. 200						Untreated steel	Concrete
					<i>Inches per hour</i>	<i>Inches per inch of soil</i>	<i>pH</i>				
	70-90	65-85	60-80	40-60	0.6-2.0	0.15-0.17	7.4-7.8	Low	High	High	Low.
	70-90	65-85	55-80	35-45	6.0-20.0	0.10-0.14	6.1-6.5	Low	High	Moderate	Low.
	100	100	95-100	85-95	0.2-0.6	0.12-0.18	7.4-8.4	High	Moderate or high.	High	Low.
	85-100	75-100	60-70	30-40	6.0-20.0	0.10-0.16	6.1-7.3	Low	Moderate	Moderate	Low.
	90-100	85-100	80-90	50-70	0.6-2.0	0.15-0.20	7.4-7.8	Moderate	High	High	Low.
	95-100	95-100	90-100	70-90	0.06-0.2	0.13-0.18	7.4-8.4	Moderate or high.	Moderate or high.	High	Low.
	100	100	90-100	75-95	0.06-0.2	0.13-0.18	7.4-7.8	High	Moderate	High	Low.
	100	100	95-100	85-95	0.06-0.2	0.13-0.18	7.9-8.4	High	Moderate	High	Low.
	100	100	95-100	90-95	0.06-0.2	0.13-0.18	7.4-8.4	High	High	High	Low.
	25-30	15-25	5-15	0-15	<20.0	0.03-0.05	7.8-8.4	Low	Low	High	Low.
	85-100	75-100	70-100	60-95	0.6-2.0	0.14-0.20	7.9-8.4	Moderate	High	High	Low.
	90-100	85-100	80-95	60-70	0.6-2.0	0.14-0.18	6.6-7.3	Moderate	High	High	Low.
0-15	65-90	60-85	55-80	40-60	2.0-6.0	0.10-0.14	7.4-8.4	Low	High	High	Low.
	65-95	55-90	40-70	20-40	2.0-6.0	0.11-0.16	6.6-7.3	Low	Moderate	High	Low.
	95-100	70-95	60-90	40-70	0.6-2.0	0.14-0.18	7.9-8.4	Low	High	High	Low.
0-35	40-50	35-50	30-40	20-30	0.6-2.0	0.10-0.12	7.9-8.4	Low	Moderate	High	Low.

TABLE 4.—Estimated soil properties

Soil series and map symbols	Depth to bedrock and gravel	Depth from surface	Dominant USDA texture	Classification	
				Unified	AASHTO
	<i>Inches</i>	<i>Inches</i>			
*Talag: Taa, Tab For properties of Allentine soil in Tab, refer to Allentine series.	>60	0-22 22-49	Clay..... Clay loam.....	CL or CH CL	A-7 A-6
Tarrete: Tb	>60	0-7 7-60	Silty clay..... Clay.....	CL or CH CH	A-7 A-7
Terrace escarpments: TCa, TCb. Too variable to rate.					
*Terry: Td, TE For properties of Travessilla soil in TE, refer to Travessilla series.	20-40 (sandstone)	0-25 25	Sandy loam..... Sandstone.	SM	A-2, A-4, or A-1
Teton: TFa, TFb	20-40 (shale)	0-29 29	Loam..... Sandstone.	ML or SM	A-4
*Thedalund: Tg, THa, THb, THc, THd, THe, THf, THg, THh, THk, THl, THm, THn, Tho. For properties of Clapper soil in THa, of Cushman soil in THb, of Fort Collins soil in THc, of McRae soil in THd, of Midway soil in THe, of Nelson soil in THf, of Travessilla soil in THk, and of Wibaux soils in THl, THm, THn, and Tho, refer to Clapper, Cushman, Fort Collins, McRae, Midway, Nelson, Travessilla, and Wibaux series, respectively. Rock outcrop parts of THg and THh are too variable to rate.	20-40 (shale)	0-28 28	Loam..... Shale.	ML or SM	A-4
*Thurlow: Tk, Tm, Tn, To For properties of Midway soil in To, refer to Midway series.	>60	0-61	Silty clay loam.....	CL	A-7
*Toluca: Tp For properties of Harvey soil, refer to Harvey series.	>40 (sand and gravel)	0-17 17-41 41-60	Clay loam, loam..... Fine sandy loam..... Very gravelly sand.....	CL SM GP or GW	A-6 A-4 A-1
*Travessilla: TR, TS For properties of Thedalund soil in TS, refer to Thedalund series. Rock outcrop part of TR is too variable to rate.	6-20 (hard sandstone)	0-18 18	Sandy loam..... Sandstone.	SM	A-2 or A-1
Trulon Mapped only with Lap soils.	20-40 (limestone)	0-30 30	Loam..... Limestone.	ML or GM	A-4 or A-2
Tullock: Tu	20-40 (sandstone)	0-38 38	Loamy fine sand, loamy sand. Sandstone.	SM	A-2
*Twin Creek: Tv, Tw, Tx, TY For properties of Korchea soil in TY, refer to Korchea series.	>60	0-60	Loam.....	ML	A-4
Vananda: Va, Vc	>60	0-60	Clay.....	CL or CH	A-7
*Vebar: Vd, Ve, VF, VH, VM For properties of Castner soils in VF and VH, refer to Castner series.	20-40 (sandstone)	0-40 40	Sandy loam..... Sandstone.	SM	A-4
Wages: Wa, Wb, Wc	>60	0-31 31-60	Clay loam, loam..... Fine sandy loam.....	ML, ML-CL, or CL SM	A-4 or A-6 A-4



significant in engineering—Continued

Per- centage larger than 3 inches	Percentage passing sieve—				Permea- bility	Available water capacity	Reaction	Shrink- swell potential	Frost- action potential	Corrosivity	
	No. 4	No. 10	No. 40	No. 200						Untreated steel	Concrete
					<i>Inches per hour</i>	<i>Inches per inch of soil</i>	<i>pH</i>				
	100 90-100	100 90-100	90-100 80-100	75-95 70-85	<0.06 0.06-0.2	0.13-0.18 0.14-0.18	7.9-8.4 8.5-9.0	High Moderate	Moderate High	High High	Low. Low.
	90-100 90-100	85-100 85-100	80-100 80-100	80-95 70-95	0.06-0.2 0.06-0.2	0.13-0.18 0.13-0.18	6.6-7.3 7.4-8.4	High High	Moderate Moderate	High High	Low. Low.
	70-100	60-100	40-70	20-40	6.0-20.0	0.10-0.16	7.4-8.4	Low	Moderate	High	Low.
	75-95	70-90	55-80	40-60	0.6-2.0	0.15-0.20	6.6-7.3	Low	High	High	Low.
0-30	80-100	70-100	65-95	45-75	0.6-2.0	0.14-0.20	7.4-7.8	Low	High	High	Low.
	100	100	95-100	85-95	0.2-0.6	0.14-0.20	7.9-8.4	Moderate	High	High	Low.
	85-100 85-100 30-40	75-100 75-100 25-35	70-100 65-95 15-20	50-80 35-50 0-5	0.6-2.0 0.6-2.0 >20.0	0.15-0.18 0.13-0.16 0.03-0.05	7.4-7.8 7.9-8.4 7.9-8.4	Moderate Low Low	High High Low	High High High	Low. Low. Low.
0-30	65-90	60-85	40-65	20-35	6.0-20.0	0.10-0.14	7.4-8.4	Low	Moderate	High	Low.
	55-85	50-75	40-70	30-55	0.2-0.6	0.11-0.16	7.4-7.8	Low	High or moder- ate.	High	Low.
	100	100	60-75	15-30	6.0-20.0	0.08-0.10	7.9-8.4	Low	Low	High	Low.
	90-100	80-100	85-95	50-75	0.6-2.0	0.14-0.20	7.4-8.4	Low	High	High	Low.
	100	100	90-100	75-95	<0.06	0.13-0.18	8.5-9.0	High	Moderate	High	Moderate.
	100	100	70-80	35-50	2.0-6.0	0.11-0.16	7.4-7.8	Low or moder- ate.	High	High	Low.
	100	100	85-100	60-80	0.6-2.0	0.14-0.20	7.4-8.4	Low or moder- ate.	High	High	Low.
	100	100	75-85	40-50	0.6-2.0	0.13-0.16	7.4-8.4	Low	High	High	Low.

TABLE 4.—*Estimated soil properties*

Soil series and map symbols	Depth to bedrock and gravel	Depth from surface	Dominant USDA texture	Classification	
				Unified	AASHTO
<p>*Wayden: WD, WE, WF, WG, WH, WI, WK, WL, WM, WN, WO. For properties of Arnegard soil in WF, of Grail soil in WG, of Judith soil in WH, of Regent soil in WI, and of Savage soil in WK, refer to Arnegard, Grail, Judith, Regent, and Savage series, respectively. Rock outcrop parts of WL and WM and Shale outcrop part of WN are too variable to rate.</p>	Inches 10–20 (hard shale)	Inches 0–19 19	Silty clay loam..... Shale.	CL	A-7
<p>*Wibaux: Wp, Wr..... For properties of Spearman soil in Wr, refer to Spearman series.</p>	8–20 (hard shale)	0–9 9	Channery loam..... Shale.	GM	A-2 or A-1
<p>*Windham: Ws, WT, WU, WV, WW, WX..... For properties of Arnegard soil in WU, of Norbert soil in WV, of Wayden soil in WW, and of Lap soil in WX, refer to Arnegard, Norbert, Wayden, and Lap series, respectively.</p>	>60	0–60	Very gravelly loam .....	GM	A-2 or A-1
<p>Winnett: Wy .....</p>	20–40 (shale)	0–26 26	Clay..... Shale.	CL or CH	A-7
<p>Xavier: Xa, Xc, Xe, Xh, Xk..... For properties of Shaak soils in Xh and Xk, refer to Shaak series.</p>	>60	0–16 16–60	Silty clay loam..... Silt loam.....	CL ML	A-6 A-4

estimated soil properties significant to engineering and interpretations for various engineering uses of the soils.

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in tables 4 and 5, and it also can be used to make other useful maps.

This information, however, does not eliminate the need for further investigations at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths greater than those shown in the tables, generally depths of more than 6 feet. Also, inspection of sites, especially the small ones, is needed because many delineated areas of a given soil mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have special meaning to soil scientists but are not known to all engineers. The Glossary defines many of these terms as they are commonly used in soil science.

#### **Engineering classification systems**

The two systems most commonly used in classifying samples of soils for engineering are the Unified system (2), used by the Soil Conservation Service, the Department of Defense, and other agencies, and the AASHTO system (1), adopted by the American Asso-

ciation of State Highway and Transportation Officials.

In the Unified system soils are classified according to particle-size distribution, plasticity, liquid limit, and organic matter. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. The Big Horn County Area has no highly organic soils. Soils on the borderline between two classes are designated by symbols for both classes; for example, ML-CL.

The AASHTO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system a soil is placed in one of seven basic groups that range from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A-1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A-7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A-1, A-2, and A-7 groups are divided as follows: A-1-a, A-1-b; A-2-4, A-2-5, A-2-6, A-2-7; and A-7-5 and A-7-6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from



*significant in engineering—Continued*

Per- centage larger than 3 inches	Percentage passing sieve—				Permea- bility	Available water capacity	Reaction	Shrink- swell potential	Frost- action potential	Corrosivity	
	No. 4	No. 10	No. 40	No. 200						Untreated steel	Concrete
	100	100	95-100	85-90	<i>Inches per hour</i> 0.6-2.0	<i>Inches per inch of soil</i> 0.14-0.20	<i>pH</i> 7.9-8.4	Moderate	High	High	Low.
15-35	35-65	30-60	15-50	15-35	0.6-2.0	0.08-0.10	7.4-7.8	Low	Moderate or low.	High	Low.
30-50	35-55	30-50	30-45	20-35	0.2-0.6	0.06-0.08	7.4-7.8	Low	Low	High	Low.
	100	100	95-100	75-90	<0.06	0.12-0.18	8.0-8.5	High	Moderate	High	Moderate.
	100	100	95-100	85-95	0.6-2.0	0.14-0.20	7.4-7.8	Moderate	High	High	Low.
	100	100	95-100	80-90	0.6-2.0	0.15-0.22	7.4-8.4	Low	High	High	Low.

0 for the best material to 20 or more for the poorest. The estimated classification, without group index numbers, is shown in table 4 for all soils mapped in the Area.

***Estimated soil properties significant in engineering***

Several estimated soil properties significant in engineering are shown in table 4. These estimates are made for typical soil profiles, by layers sufficiently different to have different significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. Following are explanations of the columns in table 4.

Depth to bedrock and gravel is the distance from the surface of the soil to the upper surface of the rock layer.

Depth to seasonal high water table is not estimated for the soils of the Big Horn County Area, because the seasonal high water table is at a depth of 5 feet or more for most soils. It is at a depth of 1½ to 3 feet in Shonkin clay loam; at a depth of less than 3 feet in Haverson and Lohmiller soils, wet; at a depth of 2 to 5 feet in Haverson loam, saline, and Kyle clay, saline; at a depth of 3 to 5 feet in Haverson soils, saline, Korchea and Frazer soils, water table, and Lohmiller silty clay, saline, 2 to 4 percent slopes; and at a depth of 3 to 6 feet in Saline land.

Soil texture is described in table 4 in the standard terms used by the Department of Agriculture. These terms take into account the relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loamy sand." "Sand," "silt," "clay," and some of the other terms used in USDA textural classification are defined in the Glossary of this soil survey.

Permeability is the quality of a soil that enables it to transmit water or air. It is estimated on the basis of soil characteristics observed in the field, particularly structure and texture. The estimates in table 4 do not take into account lateral seepage of such transient soil features as plowpans and surface crusts. A rate of less than 0.2 inch per hour is slow or very slow; 0.2 to 0.6 inch per hour is moderately slow; 0.6 inch to 2 inches, moderate; 2 to 6 inches, moderately rapid; and more than 6 inches, rapid or very rapid.

Available water capacity is the ability of a soil to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crop plants.

Reaction is the degree of acidity or alkalinity of a soil, expressed as a pH value. The pH value and terms

TABLE 5.—*Interpretations of engineering*

[An asterisk in the first column indicates that at least one mapping unit in the series is made up of two or more kinds of soil. The instructions for referring to other

Soil series and map symbols	Degree and kind of limitations for—			
	Septic-tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements
*Abac: Aa, AB, AC, AD For interpretations of the Bitton soil in AC, refer to the Bitton series. Rock outcrop part of AD is too variable to rate.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: slopes are more than 7 percent; bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.
*Absarokee: Ae, Af, Ag, AH, Ak, AL, AM For interpretations of the Castner soils in Ak, and AL, and Armington soils in AM, refer to the Castner and Armington series, respectively.	Moderate: bedrock at a depth of less than 40 inches. Severe where slopes are more than 15 percent.	Severe: bedrock at a depth of less than 40 inches; slopes are more than 7 percent in places.	Severe: bedrock at a depth of less than 40 inches.	Severe: bedrock at a depth of less than 40 inches; slopes are more than 15 percent in places.
*Absher: An For interpretations of the Nobe soil, refer to the Nobe series.	Severe: very slow permeability.	Slight where slopes are 1 percent. Moderate where slopes are 2 to 4 percent.	Severe: clay texture.	Severe: high shrink-swell potential.
*Adel: AO For interpretations of the Mayflower soil, refer to the Mayflower series.	Moderate: bedrock at a depth of 40 to 60 inches. Severe where bedrock is at a depth of less than 48 inches.	Moderate where slopes are 4 to 7 percent; moderate permeability. Severe where slopes are more than 7 percent; moderate permeability.	Moderate: bedrock at a depth of 40 to 60 inches.	Severe: high potential frost action.
Adger: Ap	Severe: slow permeability.	Slight where slopes are 0 to 1 percent. Moderate where slopes are 2 to 7 percent.	Severe: clay texture.	Severe: high shrink-swell potential.
Alice: Ar	Slight where slopes are 4 to 7 percent. Moderate where slopes are 8 to 15 percent.	Severe: moderately rapid permeability.	Slight where slopes are 4 to 7 percent. Moderate where slopes are 8 to 15 percent.	Moderate: moderate potential frost action.
*Allentine: Asa, Asb, Asc, Asd For interpretations of the Bone soils in Asc and Asd, refer to the Bone series.	Severe: very slow permeability.	Slight where slopes are 0 to 1 percent. Moderate where slopes are 2 to 4 percent.	Severe: clay texture.	Severe: high shrink-swell potential.
Alluvial land: ATa, ATb, ATc. Too variable to rate.				
*Amherst: Au, AVa, AVb, AVc, AVd For interpretations of the Maginnis soil in AVd, refer to the Maginnis series.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 7 percent in places.	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.



*properties of the soils*

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully series in the first column of this table]

Degree and kind of limitations for— Continued		Suitability as a source of—			Soil features affecting—		
Sanitary landfills (trench type) <sup>1</sup>	Roads and parking areas	Road fill	Sand or gravel	Topsoil	Pond reservoir areas	Dams, dikes, and levees	Drainage for crops and pasture
Severe: bedrock at a depth of less than 20 inches; slopes are more than 25 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Poor: bedrock at a depth of less than 20 inches.	Not a source.	Poor: coarse fragments on surface; less than 8 inches thick.	Bedrock at a depth of less than 20 inches.	Bedrock at a depth of less than 20 inches.	Not applicable.
Severe: bedrock at a depth of less than 40 inches; slopes are more than 25 percent in places.	Moderate or severe: high or moderate shrink-swell potential; slopes are more than 15 percent in places.	Poor: high or moderate shrink-swell potential; slopes of more than 15 percent in places; bedrock at a depth of 20 to 40 inches.	Not a source.	Fair: silty clay loam texture.	Bedrock at a depth of 20 to 40 inches.	Moderate or high shrink-swell potential; fair or good compaction characteristics; bedrock at a depth of 20 to 40 inches.	Not applicable.
Severe: clay texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Poor: less than 8 inches thick; clay texture.	All features favorable.	Medium compressibility; low shear strength; high shrink-swell potential.	Not applicable.
Severe: bedrock at a depth of 40 to 60 inches.	Severe: high potential frost action.	Poor: high potential frost action.	Not a source.	Good .....	Moderately steep.	Medium piping hazard; bedrock at a depth of 40 to 60 inches.	Not applicable.
Severe: clay texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Poor: clay texture.	All features favorable.	Medium compressibility; high shrink-swell potential; low shear strength.	Slow permeability.
Severe: moderately rapid permeability.	Moderate: moderate potential frost action.	Fair: moderate potential frost action.	Poor for sand; excess fines.	Good .....	High seepage potential.	Medium piping hazard.	Not applicable.
Severe: clay texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Poor: clay texture.	All features favorable.	Medium compressibility; high shrink-swell potential; low shear strength.	Very slow permeability.
Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.	Poor: bedrock at a depth of less than 20 inches; slopes are more than 25 percent in places.	Not a source.	Poor: more than 15 percent coarse fragments.	Bedrock at a depth of less than 20 inches.	Bedrock at a depth of less than 20 inches.	Not applicable.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—			
	Septic-tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements
Armington: AWA, AWb .....	Severe: very slow permeability.	Severe: slopes are more than 7 percent.	Severe: clay texture.	Severe: high shrink-swell potential.
Arnegard: Axa, Axb, Axc .....	Moderate: slopes are 2 to 15 percent; moderate permeability.	Moderate where slopes are 2 to 7 percent. Severe where slopes are 8 to 15 percent.	Moderate: clay loam texture.	Severe: high potential frost action.
*Arvada: Ayd, Aye..... For interpretations of the Bone soil in Aye, refer to the Bone series.	Severe: very slow permeability.	Moderate: slopes are 2 to 4 percent.	Severe: clay and silty clay texture.	Severe: high shrink-swell potential.
Ascalon: Az .....	Moderate: moderate permeability.	Severe: moderately rapid permeability below a depth of 30 inches.	Slight .....	Moderate: moderate potential frost action.
Babb: BA, BB.....	Moderate where slopes are 8 to 15 percent; moderate permeability. Severe where slopes are more than 15 percent.	Severe: slopes are more than 7 percent; moderately rapid permeability below a depth of 20 inches.	Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Moderate where slopes are 4 to 15 percent. Severe where slopes are more than 15 percent.
*Beauvais: Bc, Bd, Be, Bf..... For interpretations of the Gilt Edge soil in Bf, refer to the Gilt Edge series.	Severe: slopes are 8 to 15 percent; moderately slow permeability.	Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Slight where slopes are less than 8 percent. Moderate where slopes are 8 to 15 percent.	Severe: high potential frost action.
*Belfield: Bg, Bh, Bk, Bm, Bn, Bo..... For interpretations of the Adger soils in Bm, Bn, and Bo, refer to the Adger series.	Severe: moderately slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 7 percent.	Slight .....	Severe: high potential frost action.
Benteen: Bp, Br.....	Severe: bedrock at a depth of 20 to 40 inches.	Severe: slopes are more than 7 percent; bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action; bedrock at a depth of 20 to 40 inches.
Bew: Bs, Bt .....	Severe: slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 4 percent.	Severe: clay texture.	Severe: high shrink-swell potential.



*properties of the soils—Continued*

Degree and kind of limitations for— Continued		Suitability as a source of—			Soil features affecting—		
Sanitary landfills (trench type) <sup>1</sup>	Roads and parking areas	Road fill	Sand or gravel	Topsoil	Pond reservoir areas	Dams, dikes, and levees	Drainage for crops and pasture
Severe: clay texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Poor: clay texture.	Moderately steep.	Poor compaction characteristics; high shrink-swell potential; low shear strength.	Not applicable.
Moderate: clay loam texture.	Severe: high potential frost action; low shear strength.	Poor: high potential frost action; low shear strength.	Not a source.	Good where slopes are less than 8 percent. Fair where slopes are 8 to 15 percent.	Slopes are more than 8 percent in places.	Medium piping hazard; low shear strength.	All features favorable.
Severe: clay and silty clay texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Poor: less than 8 inches thick.	All features favorable.	Poor compaction characteristics; high shrink-swell potential; low shear strength.	Very slow permeability.
Severe: moderately rapid permeability below a depth of 30 inches.	Moderate: moderate potential frost action.	Fair: moderate potential frost action.	Poor for sand: excess fines.	Fair: sandy clay loam texture.	Moderately rapid permeability below a depth of 30 inches.	Piping hazard.	Not applicable.
Severe: moderately rapid permeability below a depth of 20 inches.	Severe: slopes are more than 15 percent.	Fair or poor: slopes are more than 25 percent in places; moderate potential frost action.	Poor for gravel: excess fines.	Poor: more than 15 percent coarse fragments.	High seepage potential; moderately rapid permeability below a depth of 20 inches.	Steep slopes; piping hazard.	Not applicable.
Moderate: silty clay loam texture.	Severe: high potential frost action.	Poor: high potential frost action.	Not a source.	Fair: silty clay loam texture.	Moderate seepage potential.	Medium piping hazard.	Moderately slow permeability.
Moderate: silty clay loam texture.	Severe: high potential frost action; low shear strength.	Poor: high potential frost action; low shear strength.	Not a source.	Fair: silty clay loam texture.	All features favorable.	Moderate shrink-swell potential; low shear strength.	Moderately slow permeability.
Severe: bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action; slopes are more than 15 percent.	Poor: high potential frost action; bedrock at a depth of 20 to 40 inches.	Not a source.	Fair: clay loam texture.	Bedrock at a depth of 20 to 40 inches.	High piping hazard; bedrock at a depth of 20 to 40 inches.	Not applicable.
Severe: clay texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Poor: clay texture.	All features favorable.	High compressibility; poor compaction characteristics; high shrink-swell potential; low shear strength.	Slow permeability.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—			
	Septic-tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements
Bitton: BU, BV	Slight where slopes are 2 to 7 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent	Severe: rapid permeability.	Severe: very gravelly material.	Slight where slopes are less than 15 percent. Severe where slopes are more than 15 percent.
Bone: Bw	Severe: very slow permeability.	Slight where slopes are 0 to 1 percent. Moderate where slopes are 2 to 4 percent.	Severe: clay texture.	Severe: high shrink-swell potential.
*Castner: CA, CB, CC, CD For interpretations of the Reeder soils in CA and CB, and Vebar soil in CD, refer to the Reeder and Vebar series, respectively. Rock outcrop part of CC is too variable to rate.	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.
Cherry: Ce	Severe: moderately slow permeability.	Moderate: slopes are 2 to 7 percent.	Slight: slopes are 2 to 7 percent.	Severe: high potential frost action.
Chugter: Cf, CG	Moderate: moderate permeability; slopes are 8 to 15 percent in places.	Moderate where slopes are 2 to 7 percent; moderate permeability. Severe where slopes are 7 to 15 percent.	Slight where slopes are 2 to 8 percent. Moderate where slopes are 8 to 15 percent.	Severe: high potential frost action.
*Clapper: CH, CK For interpretations of the Harvey soil in CH and the Midway soil in CK, refer to the Harvey and Midway series, respectively.	Moderate where slopes are 8 to 15 percent; moderate permeability. Severe where slopes are more than 15 percent.	Severe: slopes are more than 7 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.
*Colby: Cm, Cn, Co, Cp, Cr, Cs, Ct, CU, Cv, CW, CX, CY. For interpretations of the Beauvais soils in Cs and Ct, the Clapper soil in CU, the Keiser soil in Cv, and the Midway soil in CW, refer to the Beauvais, Clapper, Keiser, and Midway series, respectively.	Moderate: moderate permeability; slopes are 8 to 15 percent in places.	Slight where slopes are 1 to 2 percent. Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Slight where slopes are 1 to 8 percent. Moderate where slopes are 8 to 15 percent.	Severe: high potential frost action.
Cushman: Cz	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action; bedrock at a depth of 20 to 40 inches.



*properties of the soils—Continued*

Degree and kind of limitations for— Continued		Suitability as a source of—			Soil features affecting—		
Sanitary landfills (trench type) <sup>1</sup>	Roads and parking areas	Road fill	Sand or gravel	Topsoil	Pond reservoir areas	Dams, dikes, and levees	Drainage for crops and pasture
Severe: rapid permeability.	Moderate: moderate potential frost action. Severe where slopes are more than 15 percent.	Good .....	Poor for gravel: excess fines.	Poor: more than 15 percent coarse fragments.	Rapid permeability.	Moderate compacted permeability; medium piping hazard.	Not applicable.
Severe: clay texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Poor: high salinity.	All features favorable.	High compressibility; high shrink-swell potential; low shear strength.	Very slow permeability.
Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.	Poor: less than 20 inches thick.	Not a source.	Poor: more than 15 percent coarse fragments.	Bedrock at a depth of less than 20 inches.	Bedrock at a depth of less than 20 inches.	Not applicable.
Moderate: silty clay loam texture.	Severe: high potential frost action; low shear strength.	Poor: high potential frost action; low shear strength.	Not a source.	Fair: silty clay loam texture.	Slopes are more than 8 percent in places.	Moderate shrink-swell potential; low shear strength.	Moderately slow permeability.
Slight .....	Severe: high potential frost action.	Poor: high potential frost action.	Not a source.	Good .....	Moderate permeability.	Moderate compacted permeability; high piping hazard.	Unstable ditch banks.
Slight where slopes are 8 to 15 percent. Moderate where slopes are 15 to 25 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Slight .....	Poor for gravel: excess fines.	Poor: more than 15 percent coarse fragments.	Slopes are more than 8 percent.	High piping hazard.	Not applicable.
Moderate: silty clay loam texture.	Severe: high potential frost action.	Poor: high potential frost action.	Not a source.	Good to fair: silt loam and silty clay loam texture.	Moderate permeability.	Moderate permeability; erodible; medium shear strength.	Not applicable.
Severe: bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action.	Poor: high potential frost action; bedrock at a depth of 20 to 40 inches.	Not a source.	Fair: clay loam texture.	Bedrock at a depth of 20 to 40 inches.	Medium shear strength; bedrock at a depth of 20 to 40 inches.	Not applicable.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—			
	Septic-tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements
*Danvers: Da, Db, Dc, Dd, De, Df, Dg For interpretations of the Judith soils in De, Df, and Dg, refer to the Judith series.	Moderate: moderate permeability; slopes are 8 to 15 percent in places.	Moderate: moderate permeability. Severe where slopes are more than 7 percent.	Slight where slopes are 0 to 8 percent. Moderate where slopes are 8 to 15 percent.	Severe: high potential frost action.
Darret Mapped only with Reeder soils.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 7 percent in places.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.
*Dast: DHa, DHb, DHc, DHd, Dk For interpretations of the Parshall soil in Dk, refer to the Parshall series.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 7 percent in places.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 15 percent in places.
*Doney: DMA, DMB, Dn, DOa, DOB, DOc, DOD, DOe For interpretations of the Reeder soil in Dn, the Ringling soils in DOa, DOB, and DOc, and the Wayden soil in DOe, refer to the Reeder, Ringling and Wayden series, respectively. Rock outcrop part of DOD is too variable to rate.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 7 percent in places.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 15 percent in places.
*Duncom: Dp, DR, DS, DT For interpretations of the Tarrete soils in DS and DT, refer to the Tarrete series.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 7 percent.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 20 percent in places.
Eltsac: Ec, Ed, EH	Severe: bedrock at a depth of 20 to 40 inches; very slow permeability.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 7 percent in places.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 15 percent in places.
*Farnuf: Fa, Fb, Fc, FD For interpretations of the Doney soil in FD, refer to the Doney series.	Moderate: moderate permeability; slopes are more than 8 percent in places.	Moderate where slopes are 2 to 7 percent; moderate permeability. Severe where slopes are more than 7 percent.	Slight where slopes are 0 to 8 percent. Moderate where slopes are 8 to 15 percent.	Severe: high potential frost action.
Fergus: Fe, Ff, Fg	Severe: moderately slow permeability.	Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Slight where slopes are 0 to 8 percent. Moderate where slopes are 8 to 15 percent.	Severe: high potential frost action.
Fort Collins: Fh, Fk, Fm, Fn	Moderate: moderate permeability.	Moderate: moderate permeability; slopes are 2 to 7 percent.	Slight	Severe: high potential frost action.



*properties of the soils—Continued*

Degree and kind of limitations for— Continued		Suitability as a source of—			Soil features affecting—		
Sanitary landfills (trench type) <sup>1</sup>	Roads and parking areas	Road fill	Sand or gravel	Topsoil	Pond reservoir areas	Dams, dikes, and levees	Drainage for crops and pasture
Moderate: silty clay loam texture.	Severe: high potential frost action.	Poor: high po- tential frost action.	Not a source.	Fair: silty clay loam texture.	Moderate per- meability.	Moderate shrink-swell potential.	All fea- tures favor- able.
Severe: bedrock at a depth of 20 to 40 inches.	Moderate or severe: moder- ate to high potential frost action.	Poor: bedrock at a depth of 20 to 40 inches.	Not a source.	Fair: silty clay loam texture.	Bedrock at a depth of 20 to 40 inches.	Fair compaction characteris- tics; bedrock at a depth of 20 to 40 inches.	Not ap- plicable.
Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 25 per- cent in places.	Moderate: moder- ate potential frost action. Severe where slopes are more than 15 per- cent.	Poor: bedrock at a depth of 20 to 40 inches.	Not a source.	Fair where slopes are 4 to 15 percent. Poor where slopes are more than 15 percent.	Steep slopes; moderately rapid perme- ability.	Medium piping hazard; bed- rock at a depth of 20 to 40 inches.	Not ap- plicable.
Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 25 per- cent in places.	Severe: slopes are more than 15 percent.	Poor: bedrock at a depth of 20 to 40 inches.	Not a source.	Poor: more than 15 per- cent coarse fragments.	Bedrock at a depth of 20 to 40 inches; moderately steep and steep in places.	Low shear strength; high piping haz- ard; bedrock at a depth of 20 to 40 inches.	Not ap- plicable.
Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.	Poor: bedrock at a depth of less than 20 inches.	Not a source.	Poor: more than 15 per- cent coarse fragments.	Bedrock at a depth of less than 20 inches.	Bedrock at a depth of less than 20 inches.	Not ap- plicable.
Severe: bedrock at a depth of 20 to 40 inches.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength; bedrock at a depth of 20 to 40 inches.	Not a source.	Poor: clay tex- ture.	Shale at a depth of 20 to 40 in- ches; moder- ately steep in places.	High compres- sibility and shrink-swell potential; low shear strength; bed- rock at a depth of 20 to 40 inches.	Not ap- plicable.
Slight -----	Severe: high potential frost action.	Poor: high po- tential frost action.	Not a source.	Good where slopes are 0 to 8 percent. Fair where slopes are 8 to 15 percent.	Moderate slopes in places.	High piping hazard.	Unstable ditch banks.
Moderate: silty clay loam tex- ture.	Severe: high potential frost action.	Poor: high po- tential frost action.	Not a source.	Good where slopes are 0 to 8 percent. Fair where slopes are 8 to 15 percent.	All features favorable.	Fair: fair com- paction char- acteristics; medium shear strength; high piping hazard.	Moderate- ly slow perme- ability.
Slight -----	Severe: high potential frost action.	Poor: high po- tential frost action.	Not a source.	Fair: clay loam texture.	All features favorable.	High piping hazard.	All fea- tures favor- able.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—			
	Septic-tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements
*Frazer: Fo, Fr, Fs, FT For interpretations of the Korchea soil in FT, refer to the Korchea series.	Severe: slow permeability; flooding hazard.	Severe: flooding hazard.	Moderate: flooding hazard on river terraces.	Severe: high potential frost action; flooding hazard.
*Gilt Edge: Gc, Gd, Ge, Gf For interpretations of the Bone soils in Ge and Gf, refer to the Bone series.	Severe: slow permeability.	Slight where slopes are 0 to 1 percent. Moderate where slopes are 2 to 4 percent.	Slight	Severe: high shrink-swell potential.
Glenberg: Gg, Gh, Gk, Gm	Severe: flooding hazard.	Severe: moderately rapid permeability; flooding hazard.	Slight	Severe: flooding hazard.
Grail: Gn, Go, Gr, GS, Gt	Severe: moderately slow permeability; slopes are more than 15 percent in places.	Slight where slopes are 0 to 1 percent. Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Moderate where slopes are 0 to 15 percent; silty clay, clay loam texture. Severe where slopes are more than 15 percent.	Severe: high shrink-swell potential.
*Hanson: HA, HB For interpretations of the Babb soil in HB, refer to the Babb series.	Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Severe: slopes are more than 7 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.
Harvey: Hca, Hcb, Hcc, Hd, He	Moderate: moderate permeability; slopes are 8 to 15 percent in places.	Moderate where slopes are 2 to 7 percent; moderate permeability. Severe where slopes are more than 7 percent.	Slight where slopes are 0 to 8 percent. Moderate where slopes are 8 to 15 percent.	Moderate: high potential frost action.
*Haverson: Hfa, Hfb, Hfc, Hfd, Hfe, Hff, Hfh, HGa, HGb, HGc, Hh, HK. For interpretations of the Hysham soil in Hfh, the Glenberg soil in HGa, and the Lohmiller soils in HGb, HGc, and Hh, refer to the Hysham, Glenberg, and Lohmiller series, respectively.	Moderate: moderate permeability; flooding hazard and high water table on the river terraces.	Moderate: moderate permeability; flooding hazard and high water table on the river terraces.	Slight or moderate: flooding hazard on the river terraces.	Severe: high potential frost action; flooding hazard and high water table on the river terraces.
*Heldt: Hla, Hlb, Hlc, Hld, Hle, Hlf, Hlg For interpretations of the Hysham soils in Hlf and Hlg, refer to the Hysham series.	Severe: slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Slight where slopes are 0 to 8 percent. Moderate where slopes are 8 to 15 percent.	Severe: high potential frost action.



*properties of the soils—Continued*

Degree and kind of limitations for— Continued		Suitability as a source of—			Soil features affecting—		
Sanitary landfills (trench type) <sup>1</sup>	Roads and parking areas	Road fill	Sand or gravel	Topsoil	Pond reservoir areas	Dams, dikes, and levees	Drainage for crops and pasture
Severe: flooding hazard.	Severe: high potential frost action; low shear strength.	Poor: high potential frost action; low shear strength.	Not a source.	Fair: silty clay loam texture.	All features favorable.	Low shear strength.	Flooding hazard.
Moderate: silty clay loam texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Poor: less than 8 inches thick; clay texture.	All features favorable.	High shrink-swell potential; poor compaction characteristics; high compressibility; low shear strength.	Slow permeability.
Severe: moderately rapid permeability.	Moderate: moderate potential frost action.	Fair: moderate potential frost action.	Poor for sand: excess fines.	Good .....	Moderately rapid permeability.	High piping hazard; moderate compacted permeability.	Unstable ditch banks.
Severe: silty clay loam texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Fair: clay loam texture.	Slopes are more than 15 percent.	Medium compaction characteristics; low shear strength.	Moderately slow permeability.
Slight where slopes are 8 to 15 percent. Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Fair where slopes are 8 to 25 percent. Poor where slopes are more than 25 percent.	Poor for sand and gravel: excess fines.	Poor: more than 15 percent coarse fragments.	Very steep slopes.	High piping hazard.	Not applicable.
Slight .....	Severe: high potential frost action.	Good .....	Not a source.	Good where slopes are 0 to 8 percent. Fair where slopes are 8 to 15 percent.	Moderate permeability; slopes are 0 to 15 percent.	Medium stability and shear strength; high piping hazard.	Not applicable.
Slight or moderate: flooding hazard on the river terraces.	Severe: high potential frost action.	Poor: high potential frost action.	Not a source.	Good .....	Water table at a depth of 3 to 5 feet on the river terraces.	Low shear strength; high piping hazard.	Unstable ditch banks.
Moderate: silty clay loam texture.	Severe: high potential frost action; low shear strength.	Poor: high potential frost action; low shear strength.	Not a source.	Fair: silty clay loam texture.	Moderate slopes in places.	Fair compaction characteristics; moderate shrink-swell potential; low shear strength.	Slow permeability.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—			
	Septic-tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements
Hesper: Hma, Hmb, Hmc	Severe: moderately slow permeability.	Slight: slopes are 2 to 7 percent in places.	Slight	Moderate or severe: high or moderate potential frost action.
*Hydro: Hna, Hnb, Hnc, Hnd, Hne, Hnf, Hng, Hnh, Hnk For interpretations of the Allentine soils in Hng and Hnh, and the Gilt Edge soil in Hnk, refer to the Allentine and Gilt Edge series, respectively.	Severe: slow permeability.	Slight where slopes are 0 to 1 percent. Moderate where slopes are 2 to 7 percent.	Severe: silty clay texture.	Severe: high shrink-swell potential.
*Hysham: Ho, Hp, Hr, HS, HT For interpretations of the Midway soil in HS and the Lohmiller soil in HT, refer to the Midway and Lohmiller series, respectively.	Severe: slow permeability.	Slight where slopes are 0 to 1 percent. Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Slight where slopes are 0 to 8 percent. Moderate where slopes are 8 to 15 percent.	Severe: high potential frost action.
*Judith: Jc, Jd, Jø, Jh, Jk For interpretations of the Windham soils in Jh and Jk, refer to the Windham series.	Slight where slopes are 0 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight where slopes are 0 to 1 percent. Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Severe: very gravelly below a depth of 25 inches.	Severe: high potential frost action.
*Keiser: Kc, Kd, Kø, Kf For interpretations of the Colby soil in Kf, refer to the Colby series.	Moderate: moderate permeability.	Moderate: moderate permeability.	Slight	Severe: high potential frost action.
Kim: Kg	Moderate: moderate permeability; slopes are 8 to 15 percent in places.	Moderate where slopes are 4 to 7 percent. Severe where slopes are more than 7 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Severe: high potential frost action.
*Korchea: Kh, Kk, Km, Kn, Ko, Kp, KR For interpretations of the Frazer soil in KR, refer to the Frazer series.	Moderate: moderate permeability.	Moderate: moderate permeability.	Slight	Severe: high potential frost action.
Kyle: Ks, Kt, Ku, KV, Kw	Severe: very slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Severe: clay texture.	Severe: high shrink-swell potential.
La Fonda: La	Moderate: moderate permeability.	Moderate: moderate permeability.	Slight	Severe: high potential frost action.



*properties of the soils—Continued*

Degree and kind of limitations for— Continued		Suitability as a source of—			Soil features affecting—		
Sanitary landfills (trench type) <sup>1</sup>	Roads and parking areas	Road fill	Sand or gravel	Topsoil	Pond reservoir areas	Dams, dikes, and levees	Drainage for crops and pasture
Moderate: silty clay loam texture.	Severe: high or moderate potential frost action; low shear strength.	Poor: high potential frost action; low shear strength. Good below a depth of 40 inches.	Good for sand and clay: 4 to 5 feet of over- burden.	Poor: less than 8 inches thick.	Very rapid permeability below a depth of 40 inches.	Medium to low shear strength; high compacted permeability below a depth of 40 inches.	Moderately slow permeability.
Severe: silty clay texture.	Severe: high or moderate potential frost action; high shrink-swell potential; low shear strength.	Poor: high or moderate potential frost action.	Not a source.	Poor: silty clay texture.	Moderate slopes in places.	Medium shear strength; high piping hazard below a depth of 30 inches.	Not applicable.
Moderate: silty clay loam texture.	Severe: high potential frost action; low shear strength.	Poor: high potential frost action; low shear strength.	Not a source.	Poor: contains soluble salts and sodium.	All features favorable.	Poor compaction characteristics; medium piping hazard; low shear strength.	Unstable ditch banks.
Severe: very gravelly loam below a depth of 25 inches.	Severe: high potential frost action.	Good .....	Poor for gravel: excess fines.	Good .....	High seepage potential.	High piping hazard.	Not applicable.
Moderate: silty clay loam texture.	Severe: high potential frost action; low shear strength.	Poor: high potential frost action.	Not a source.	Fair: silty clay loam texture.	Moderate permeability.	High piping hazard.	Not applicable.
Slight .....	Severe: high potential frost action.	Poor: high potential frost action.	Not a source.	Good where slopes are 4 to 8 percent. Fair where slopes are 8 to 15 percent.	Moderate permeability.	High piping hazard; low shear strength; erodible.	Not applicable.
Slight .....	Severe: high potential frost action.	Poor: high potential frost action.	Not a source.	Good .....	Moderate seepage potential.	High piping hazard; medium shear strength; erodible.	Unstable ditch banks.
Severe: clay texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high potential frost action; low shear strength.	Not a source.	Poor: clay texture.	Moderate slopes in places.	High compressibility; high shrink-swell potential; low shear strength.	Very slow permeability.
Slight .....	Severe: high potential frost action.	Poor: high potential frost action.	Not a source.	Fair: less than 16 inches thick.	Moderate permeability.	High piping hazard.	Unstable ditch banks.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—			
	Septic-tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements
*Lap: LCa, LCb, LCc, LCd For interpretations of the Trulon soil in LCa, and the Armington soil in LCd, refer to the Trulon and Armington series, respectively.	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 7 percent in places.	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.
*Lavina: LD For interpretations of the Travessilla soil, refer to the Travessilla series.	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.
*Lennep: Lea, Leb, Lec, Led For interpretations of the Adger soils in Lec and Led, refer to the Adger series.	Severe: slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 7 percent.	Severe: silty clay texture.	Severe: high shrink-swell potential.
*Lismas: LF, LG, LH, LK, LM, LN For interpretations of the Vananda soil in LN, refer to the Vananda series. Shale outcrop parts of LK and LM are too variable to rate.	Severe: bedrock at a depth of less than 20 inches; very slow permeability; slopes are more than 15 percent.	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.
*Lohmiller: Lo, Lp, Lr, Ls, Lt, Lu, LV For interpretations of the Midway soil in LV, refer to the Midway series.	Severe: moderately slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Slight	Severe: high potential frost action.
Macar: Ma	Moderate: moderate permeability.	Moderate: moderate permeability.	Slight	Severe: high potential frost action.
*Maginnis: MB, MC For interpretation of the Windham soil in MC, refer to the Windham series. Shale outcrop part of MB is too variable to rate.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 7 percent.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent.
Marias: Md, Me, Mf, Mg	Severe: very slow permeability.	Slight where slopes are 0 to 1 percent. Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Severe: clay texture.	Severe: high shrink-swell potential.
*Maschetah: MH, MK For interpretations of the Norbert soil in MK, refer to the Norbert series.	Severe: moderately slow permeability; slopes are more than 15 percent.	Severe: slopes are more than 7 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Severe: high potential frost action.



*properties of the soils—Continued*

Degree and kind of limitations for— Continued		Suitability as a source of—			Soil features affecting—		
Sanitary landfills (trench type) <sup>1</sup>	Roads and parking areas	Road fill	Sand or gravel	Topsoil	Pond reservoir areas	Dams, dikes, and levees	Drainage for crops and pasture
Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.	Poor: bedrock at a depth of less than 20 inches.	Not a source.	Poor: more than 15 percent coarse fragments.	Bedrock at a depth of less than 20 inches.	Medium piping hazard; coarse fragments; bedrock at a depth of less than 20 inches.	Not applicable.
Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.	Poor: bedrock at a depth of less than 20 inches.	Not a source.	Poor: more than 15 percent coarse fragments.	Bedrock at a depth of less than 20 inches.	Bedrock at a depth of less than 20 inches.	Not applicable.
Severe: silty clay texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Fair: less than 16 inches thick; silty clay loam texture.	All features favorable.	Fair compaction characteristics; high shrink-swell potential; low shear strength.	Not applicable.
Severe: bedrock at a depth of less than 20 inches; slopes are more than 25 percent in places.	Severe: bedrock at a depth of less than 20 inches; high shrink-swell potential.	Poor: shale at a depth of less than 20 inches; high shrink-swell potential.	Not a source.	Poor: clay texture.	Shale at a depth of less than 20 inches.	Poor compaction characteristics; high shrink-swell potential; bedrock at a depth of less than 20 inches.	Not applicable.
Moderate: silty clay loam texture.	Severe: high potential frost action; low shear strength.	Poor: high potential frost action; low shear strength.	Not a source.	Fair: silty clay loam texture.	All features favorable.	Fair compaction characteristics; medium to low shear strength.	Moderately slow permeability.
Slight	Severe: high potential frost action.	Poor: high potential frost action.	Not a source.	Good	All features favorable.	High piping hazard.	Not applicable.
Severe: bedrock at a depth of less than 20 inches; slopes are more than 25 percent.	Severe: shale at a depth of less than 20 inches.	Poor: shale at a depth of less than 20 inches; high shrink-swell potential.	Not a source.	Poor: more than 15 percent coarse fragments; silty clay, clay texture.	Steep; bedrock at a depth of less than 20 inches.	Medium compressibility; high content of gravel and channers; bedrock at a depth of less than 20 inches.	Not applicable.
Severe: clay texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Poor: clay texture.	All features favorable.	High compressibility; high shrink-swell potential; low shear strength.	Very slow permeability.
Moderate: silty clay loam texture.	Severe: high potential frost action.	Poor: high potential frost action; slopes are more than 25 percent in places.	Not a source.	Fair where slopes are 8 to 15 percent. Poor where slopes are more than 15 percent.	Slopes are more than 15 percent in places.	Fair compaction characteristics.	Not applicable.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—			
	Septic-tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements
Mayflower: Mm, MN.....	Severe: bedrock at a depth of 20 to 40 inches.	Severe: slopes are more than 7 percent; bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.
McKenzie: Mo .....	Severe: very slow permeability.	Slight .....	Severe: clay texture.	Severe: high shrink-swell potential.
McRae: Mp, Mr, Ms, Mt.....	Moderate: moderate permeability. Severe where slopes are more than 15 percent.	Moderate where slopes are 2 to 7 percent; moderate permeability. Severe where slopes are more than 7 percent.	Slight where slopes are 0 to 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Severe: high potential frost action.
*Midway: Mu, MVa, MVb, MVc, MVd, MVe, MVf, MVg ..... For interpretations of the Lismas soils in MVC and MVD, the Thedalund soils in MVe and MVf, and the Thurlow soil in MVg, refer to the Lismas, Thedalund, and Thurlow series, respectively.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 7 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.
Morton: Mw .....	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.
*Nelson: Nd, Ne, NF..... For interpretations of the Alice soil in Ne, and the Glenberg soil in NF, refer to the Alice and Glenberg series, respectively.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: moderately rapid permeability; bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.
Neville: Ng .....	Severe: bedrock at a depth of 40 to 60 inches.	Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Moderate: bedrock at a depth of 40 to 60 inches.	Severe: high potential frost action.
Nobe ..... Mapped only with Absher soils.	Severe: very slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 4 percent.	Severe: clay texture.	Severe: high shrink-swell potential.
*Norbert: NH, NK..... For interpretations of the Eltsac soil in NH, refer to the Eltsac series. Shale outcrop part of NK is too variable to rate.	Severe: very slow permeability; bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 7 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.



*properties of the soils—Continued*

Degree and kind of limitations for— Continued		Suitability as a source of—			Soil features affecting—		
Sanitary landfills (trench type) <sup>1</sup>	Roads and parking areas	Road fill	Sand or gravel	Topsoil	Pond reservoir areas	Dams, dikes, and levees	Drainage for crops and pasture
Severe: bedrock at a depth of 20 to 40 inches.	Moderate or severe: high or moderate potential frost action; bedrock at a depth of 20 to 40 inches.	Poor: high or moderate potential frost action; bedrock at a depth of 20 to 40 inches.	Not a source.	Fair or poor: silty clay loam, silty clay texture.	Steep in places	Medium compressibility; bedrock at a depth of 20 to 40 inches.	Not applicable.
Severe: clay texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Poor: clay texture.	All features favorable.	Poor compaction characteristics; high compressibility; low shear strength.	Very slow permeability.
Slight where slopes are 0 to 15 percent. Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.	Severe: high potential frost action.	Poor: high potential frost action.	Not a source.	Good where slopes are 0 to 8 percent. Fair where slopes are 8 to 15 percent. Poor where slopes are more than 15 percent.	All features favorable.	High piping hazard.	Not applicable.
Severe: bedrock at a depth of less than 20 inches; slopes are more than 25 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Poor: shale at a depth of less than 20 inches.	Not a source.	Poor: less than 8 inches thick.	Shale at a depth of less than 20 inches.	Fair compaction characteristics; medium compressibility; shale at a depth of less than 20 inches.	Not applicable.
Severe: bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action.	Poor: high potential frost action; bedrock at a depth of 20 to 40 inches.	Not a source.	Fair: silty clay loam texture.	Moderate: moderate permeability.	Low shear strength; bedrock at a depth of 20 to 40 inches.	Not applicable.
Severe: moderately rapid permeability; bedrock at a depth of 20 to 40 inches.	Moderate: moderate potential frost action; slopes are more than 15 percent.	Poor: bedrock at a depth of 20 to 40 inches.	Not a source.	Fair: less than 16 inches thick.	Moderately rapid permeability.	Medium shear strength and piping hazard; bedrock at a depth of 20 to 40 inches.	Not applicable.
Severe: bedrock at a depth of 40 to 60 inches.	Severe: high potential frost action.	Poor: high potential frost action; bedrock at a depth of 40 to 60 inches.	Not a source.	Good	Moderate permeability.	Medium piping hazard; bedrock at a depth of 40 to 60 inches.	Not applicable.
Severe: clay texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Poor: clay texture; high content of salts.	All features favorable.	High shrink-swell potential; low shear strength.	Very slow permeability.
Severe: clay texture; bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.	Poor: shale at a depth of less than 20 inches.	Not a source.	Poor: clay texture.	Shale at a depth of less than 20 inches.	High shrink-swell potential; low shear strength; bedrock at a depth of less than 20 inches.	Not applicable.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—			
	Septic-tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements
*Nunn: Nm, Nn, No, Nr, NS For interpretations of the Midway soil in NS, refer to the Midway series.	Severe: slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Moderate: clay loam texture; slopes are 8 to 15 percent in places.	Severe: high potential frost action.
Olney: On	Slight	Moderate where slopes are 4 to 7 percent; moderately rapid permeability below a depth of 25 inches. Severe where slopes are more than 7 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Moderate: moderate potential frost action.
Parshall: Pa	Slight	Severe: moderately rapid permeability.	Slight	Moderate: moderate potential frost action.
*Peritsa: Pd, PE, PF For interpretations of the Abac soil in PE, refer to the Abac series.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action; bedrock at a depth of 20 to 40 inches.
*Pierre: Pg, Ph, Pk, PM, PN For interpretations of the Kyle soil in Pk, and the Lismas soils in PM and PN, refer to the Kyle and Lismas series, respectively.	Severe: very slow permeability; bedrock at a depth of 20 to 40 inches.	Severe: slopes are more than 7 percent in places; bedrock at a depth of 20 to 40 inches.	Severe: clay texture; bedrock at a depth of 20 to 40 inches.	Severe: high shrink-swell potential; bedrock at a depth of 20 to 40 inches.
*Pultney: PO For interpretations of the Neville soil, refer to the Neville series.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action; bedrock at a depth of 20 to 40 inches.
Quietus: QU	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 15 percent.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 15 percent.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 15 percent.	Severe: slopes are more than 15 percent; bedrock at a depth of 20 to 40 inches.
Raynesford: Ra	Severe: moderately slow permeability.	Moderate: slopes are 4 to 8 percent.	Severe: very gravelly.	Moderate or severe: high or moderate potential frost action. Good below a depth of 30 inches.



*properties of the soils—Continued*

Degree and kind of limitations for— Continued		Suitability as a source of—			Soil features affecting—		
Sanitary landfills (trench type) <sup>1</sup>	Roads and parking areas	Road fill	Sand or gravel	Topsoil	Pond reservoir areas	Dams, dikes, and levees	Drainage for crops and pasture
Moderate: clay loam texture.	Severe: high potential frost action.	Poor: high po- tential frost action.	Not a source.	Fair: silty clay loam texture.	All features favorable.	Moderate shrink-swell potential; me- dium shear strength.	All fea- tures favor- able.
Slight .....	Moderate: mod- erate potential frost action.	Fair: moderate potential frost action.	Poor for sand: excess fines.	Fair: sandy clay loam texture.	Moderate per- meability.	High piping hazard.	All fea- tures favor- able.
Severe: moder- ately rapid permeability.	Moderate: mod- erate potential frost action.	Fair: moderate potential frost action.	Poor for sand: excess fines.	Good .....	Moderately rapid perme- ability.	High piping hazard.	Not ap- plicable.
Severe: bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action.	Poor: high po- tential frost action; bed- rock at a depth of 20 to 40 inches.	Not a source.	Good .....	All features favorable.	High piping hazard; low shear strength; bedrock at a depth of 20 to 40 inches.	Not ap- plicable.
Severe: bedrock at a depth of 20 to 40 inches.	Severe: high shrink-swell potential; slopes are more than 15 per- cent in places.	Poor: high shrink-swell potential; bedrock at a depth of 20 to 40 inches.	Not a source.	Poor: clay tex- ture.	Steep in places ..	Poor compaction characteris- tics; high shrink-swell potential; low shear strength; bedrock at a depth of 20 to 40 inches.	Not ap- plicable.
Severe: bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action.	Poor: high po- tential frost action; bed- rock at a depth of 20 to 40 inches.	Not a source.	Good or fair: 0 to 15 per- cent coarse fragments.	Bedrock at a depth of 20 to 40 inches.	Medium piping hazard; me- dium shear strength; bedrock at a depth of 20 to 40 inches.	Not ap- plicable.
Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 25 per- cent in places.	Severe: slopes are more than 15 percent.	Poor: bedrock at a depth of 20 to 40 inches; slopes are as much as 25 percent.	Not a source.	Poor: slopes are more than 15 percent.	Moderately steep and steep.	Medium piping hazard; bed- rock at a depth of 20 to 40 inches.	Not ap- plicable.
Slight .....	Moderate or severe: high or moderate potential frost action.	Poor or fair: high or mod- erate poten- tial frost action. Good below a depth of 30 inches.	Poor for gravel: excess fines.	Fair: more than 5 per- cent coarse fragments.	All features favorable.	High piping hazard.	Not ap- plicable.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—			
	Septic-tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements
*Reeder: Rda, Rdb, Rdc, REa, REb, REc, REd For interpretations of the Regent soil in REa, the Rentsac soil in REb, and the Darret soils in REc and REd, refer to the Regent, Rentsac, and Darret series, respectively.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: slopes are more than 7 percent in places; bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches; high potential frost action.
Regent: Rfa, Rfc, Rfd	Severe: bedrock at a depth of 20 to 40 inches.	Severe: slopes are more than 7 percent in places; bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action; bedrock at a depth of 20 to 40 inches.
Renohill: Re	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: high shrink-swell potential; bedrock at a depth of 20 to 40 inches.
*Rentsac: RH For interpretations of the Doney soil, refer to the Doney series.	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.
*Richfield: Rk, Rlc, Rld, Rle, Rlf For interpretations of the Beauvais soils in Rle and Rlf, refer to the Beauvais series.	Severe: moderately slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 7 percent.	Slight	Severe: high potential frost action.
Ringling Mapped only with Doney soils.	Severe: slopes are more than 15 percent in places; bedrock at a depth of less than 20 inches.	Severe: slopes are more than 7 percent in places; bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of less than 20 inches.
Riverwash: RM. Too variable to rate.				
*Rock outcrop: RN, RO, RP, RR, RS. Too variable to rate. For interpretations of the Duncom soil in RN, the Lap soil in RO, the Pultney soil in RP, the Rentsac soil in RR, and the Windham soil in RS, refer to the Duncom, Lap, Pultney, Rentsac, and Windham series, respectively.				
*Rottulee: Rt, Ru, Rv, RW For interpretations of the Abac soil in RW, refer to the Abac series.	Severe: bedrock at a depth of 20 to 30 inches.	Severe: bedrock at a depth of 20 to 30 inches.	Severe: bedrock at a depth of 20 to 30 inches.	Severe: bedrock at a depth of 20 to 30 inches; high potential frost action.
Ryorp: Ry	Severe: bedrock at a depth of 20 to 40 inches.	Severe: rapid permeability; bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action; bedrock at a depth of 20 to 40 inches.



*properties of the soils—Continued*

Degree and kind of limitations for— Continued		Suitability as a source of—			Soil features affecting—		
Sanitary landfills (trench type) <sup>1</sup>	Roads and parking areas	Road fill	Sand or gravel	Topsoil	Pond reservoir areas	Dams, dikes, and levees	Drainage for crops and pasture
Severe: bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action; slopes are more than 15 percent in places.	Poor: high potential frost action; slopes are more than 25 percent in places; bedrock at a depth of 20 to 40 inches.	Not a source.	Fair: clay loam texture.	Bedrock at a depth at 20 to 40 inches; slopes are more than 15 percent in places.	Moderate stability; medium piping hazard; bedrock at a depth of 20 to 40 inches.	Not applicable.
Severe: bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action; slopes are more than 15 percent in places.	Poor: high potential frost action; bedrock at a depth of 20 to 40 inches.	Not a source.	Fair: silty clay loam texture.	Bedrock at a depth of less than 40 inches.	Fair compaction characteristics; bedrock at a depth of 20 to 40 inches.	Not applicable.
Severe: bedrock at a depth of 20 to 40 inches.	Severe: high shrink-swell potential; slopes are more than 15 percent in places.	Poor: high shrink-swell potential; bedrock at a depth of 20 to 40 inches.	Not a source.	Poor: silty clay texture.	Bedrock at a depth of 20 to 40 inches.	Fair compaction characteristics; bedrock at a depth of 20 to 40 inches.	Not applicable.
Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.	Poor: bedrock at a depth of less than 20 inches.	Not a source.	Poor: less than 8 inches thick.	Bedrock at a depth of less than 20 inches.	Bedrock at a depth of less than 20 inches.	Not applicable.
Slight or moderate: silty clay loam, silt loam texture.	Severe: high potential frost action.	Poor: high potential frost action.	Not a source.	Fair: silty clay loam texture.	All features favorable.	High piping hazard.	Unstable ditch banks.
Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent.	Poor: bedrock at a depth of less than 20 inches.	Not a source.	Poor: more than 15 percent coarse fragments.	High seepage potential.	Bedrock at a depth of less than 20 inches.	Not applicable.
Severe: bedrock at a depth of 20 to 30 inches.	Severe: high potential frost action.	Poor: high potential frost action; bedrock at a depth of 20 to 30 inches.	Not a source.	Good to poor: 0 to 40 percent coarse fragments.	Bedrock at a depth of less than 3 feet.	High piping hazard; bedrock at a depth of 20 to 30 inches.	Not applicable.
Severe: bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action.	Poor: high potential frost action; bedrock at a depth of 20 to 40 inches.	Not a source.	Poor: loose when dry.	Rapid permeability; moderately steep.	Medium piping hazard; moderately steep; bedrock at a depth of 20 to 40 inches.	Not applicable.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—			
	Septic-tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements
Saline land: SA. Too variable to rate.				
*Savage: Sd, Sea, Seb, Sec, Sed, Sef, SF For interpretations of the Wayden soil in Sef and the Frazer soil in SF, refer to the Wayden and Frazer series, respectively.	Severe: moderately slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Severe: silty clay texture.	Severe: high shrink-swell potential; slopes are more than 8 percent in places.
Sawcreek Mapped only with Splitro soils.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 15 percent in places.	Severe: rapid permeability; slopes are more than 7 percent; bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 8 percent in places.
*Searing: Sg, SH, SI For interpretations of the Ringling soil in SI, refer to the Ringling series.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches; high potential frost action.
Shaak: Ska, Skb, Skc, Skd, Ske, SM	Severe: slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Slight where slopes are 0 to 8 percent. Moderate where slopes are 8 to 15 percent.	Severe: high or moderate potential frost action; high or moderate shrink-swell potential.
*Shale outcrop: SOa, SOc, SOd. Too variable to rate. For interpretations of the Midway soil in SOc and the Norbert soil in SOd, refer to the Midway and Norbert series, respectively.				
Shonkin: Sp	Severe: slow permeability; flooding hazard; water table at a depth of 1½ to 3 feet.	Severe: water table at a depth of 1½ to 3 feet.	Severe: clay and silty clay texture; water table at a depth of 1½ to 3 feet.	Severe: flooding hazard; high shrink-swell potential; water table at a depth of 1½ to 3 feet.
Sofia: Sra, Srb	Severe: slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 4 percent.	Severe: silty clay texture.	Severe: high shrink-swell potential.



*properties of the soils—Continued*

Degree and kind of limitations for— Continued		Suitability as a source of—			Soil features affecting—		
Sanitary landfills (trench type) <sup>1</sup>	Roads and parking areas	Road fill	Sand or gravel	Topsoil	Pond reservoir areas	Dams, dikes, and levees	Drainage for crops and pasture
Severe: silty clay texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Poor: silty clay texture.	All features favorable.	High shrink- swell poten- tial; low shear strength.	Moderate- ly slow perme- ability.
Severe: bedrock at a depth of 20 to 40 inches.	Moderate where slopes are less than 15 per- cent; moderate potential frost action. Severe where slopes are more than 15 per- cent.	Poor: bedrock at a depth of 20 to 40 inches.	Not a source.	Poor: loose when dry.	Rapid perme- ability.	Moderate poten- tial frost ac- tion; bedrock at a depth of 20 to 40 inches.	Not ap- plicable.
Severe: bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action.	Poor: high po- tential frost action; bed- rock at a depth of 20 to 40 inches.	Not a source.	Fair: less than 16 inches thick. Poor where slopes are more than 15 percent.	Moderate per- meability.	High piping hazard; bed- rock at a depth of 20 to 40 inches.	Not ap- plicable.
Moderate or severe: silty clay loam, clay texture.	Severe: high or moderate potential frost action; high or moderate shrink-swell potential; low shear strength.	Poor: high or moderate po- tential frost action; high or moderate shrink-swell potential; low shear strength.	Not a source.	Fair or poor: clay, clay loam texture.	Slopes are more than 15 per- cent in places.	Low shear strength; me- dium com- pressibility.	Slow per- meabil- ity.
Severe: flooding hazard; clay and silty clay texture; water table at a depth of 1½ to 3 feet.	Severe: flooding hazard; high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Poor: clay, silty clay texture.	All features favorable.	High shrink- swell poten- tial; low shear strength.	Slow per- meabil- ity.
Severe: silty clay texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength to a depth of 40 inches, good below.	Good for gravel below a depth of 40 inches.	Poor: silty clay texture.	Very rapid per- meability be- low a depth of 40 inches.	High shrink- swell poten- tial; medium compressibil- ity; high com- pacted perme- ability below a depth of 40 inches.	Slow per- meabil- ity.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—			
	Septic-tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements
*Spearfish: SSa, SSb, SSd, SSd For interpretations of the Clapper soil in SSa, and the Pultney soils in SSd and SSd, refer to the Clapper and Pultney series, respectively. Rock outcrop part of SSb is too variable to rate.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 7 percent.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of less than 20 inches.
*Spearman: St, SU For interpretations of the Wibaux soil in SU, refer to the Wibaux series.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 7 percent in places.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 8 percent in places.
*Splitro: SVA, SVb For interpretations of the Sawcreek soil, refer to the Sawcreek series.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 7 percent.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 8 percent in places.
Stormitt: Swa, Swb, SX	Slight where slopes are 0 to 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Moderate: moderate permeability. Severe where slopes are more than 7 percent.	Severe: very gravelly texture.	Moderate: moderate potential frost action. Severe where slopes are more than 15 percent.
*Talag: Taa, Tab For interpretations of the Allentine soil in Tab, refer to the Allentine series.	Severe: very slow permeability.	Slight where slopes are 0 to 1 percent. Moderate where slopes are 2 to 7 percent.	Severe: clay texture.	Severe: high shrink-swell potential.
Tarrete: Tb	Severe: slow permeability.	Severe: slopes are more than 7 percent.	Severe: silty clay or clay texture.	Severe: high shrink-swell potential.
Terrace escarpments: TCa, TCb. Too variable to rate.				
*Terry: Td, TE For interpretations of the Travessilla soil in TE, refer to the Travessilla series.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.
Teton: TFa, TFb	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 7 percent.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 8 percent in places.



*properties of the soils—Continued*

Degree and kind of limitations for— Continued		Suitability as a source of—			Soil features affecting—		
Sanitary landfills (trench type) <sup>1</sup>	Roads and parking areas	Road fill	Sand or gravel	Topsoil	Pond reservoir areas	Dams, dikes, and levees	Drainage for crops and pasture
Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Poor: bedrock at a depth of less than 20 inches; slopes are more than 25 percent in places.	Not a source.	Fair: less than 16 inches thick.	Bedrock at a depth of less than 20 inches; steep.	Medium piping hazard; bedrock at a depth of less than 20 inches.	Not applicable.
Severe: bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action; slopes are more than 15 percent in places.	Poor: high potential frost action; bedrock at a depth of 20 to 40 inches.	Not a source.	Fair: less than 16 inches thick.	Moderate permeability.	Fair compaction characteristics; medium piping hazard; bedrock at a depth of 20 to 40 inches.	Not applicable.
Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.	Poor: bedrock at a depth of less than 20 inches.	Not a source.	Poor: loose when dry.	Moderately rapid permeability; sandstone at a depth of less than 20 inches.	Moderate permeability; medium piping hazard; bedrock at a depth of less than 20 inches.	Not applicable.
Moderate: moderate permeability. Severe where slopes are more than 25 percent.	Moderate: moderate potential frost action. Severe where slopes are more than 15 percent.	Fair: moderate potential frost action.	Poor for gravel: excess fines.	Poor: more than 15 percent coarse fragments.	Moderate permeability.	Medium piping hazard.	Not applicable.
Severe: clay texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Poor: clay texture.	All features favorable.	High shrink-swell potential; high compressibility; low shear strength.	Not applicable.
Severe: clay texture.	Severe: high shrink-swell potential; slopes are more than 15 percent; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Poor: silty clay texture.	Slopes are more than 8 percent in places.	High shrink-swell potential; low shear strength.	Not applicable.
Severe: bedrock at a depth of 20 to 40 inches.	Moderate: moderate potential frost action.	Poor: bedrock at a depth of 20 to 40 inches.	Not a source.	Good .....	High seepage potential.	Medium susceptibility to piping; bedrock at a depth of 20 to 40 inches.	Not applicable.
Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 25 percent in places.	Severe: high potential frost action; slopes are more than 15 percent in places.	Poor: high potential frost action; bedrock at a depth of 20 to 40 inches.	Not a source.	Fair where slopes are 8 to 15 percent. Poor where slopes are more than 15 percent.	Steep .....	Fair compaction characteristics; medium susceptibility to piping; bedrock at a depth of 20 to 40 inches.	Not applicable.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—			
	Septic-tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements
<p>*Thedalund: Tg, THa, THb, THc, THd, THe, THf, THg, THh, THk, THl, THm, THn, THo. For interpretations of the Clapper soil in THa, the Cushman soil in THb, the Fort Collins soil in THc, the McRae soil in THd, the Midway soil in THe, the Nelson soil in THf, the Travessilla soil in THk, and the Wibaux soils in THl, THm, THn, and THo, refer to the Clapper, Cushman, Fort Collins, McRae, Midway, Nelson, Travessilla, and Wibaux series, respectively. Rock outcrop parts of THg and THh are too variable to rate.</p>	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 7 percent in places.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 8 percent in places.
<p>*Thurlow: Tk, Tm, Tn, To. For interpretations of the Midway soil in To, refer to the Midway series.</p>	Severe: moderately slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Slight where slopes are 0 to 8 percent. Moderate where slopes are 8 to 15 percent.	Severe: high potential frost action.
<p>*Toluca: Tp. For interpretations of the Harvey soil, refer to the Harvey series.</p>	Slight	Severe: very rapid permeability below a depth of 40 inches.	Slight	Severe: high potential frost action.
<p>*Travessilla: TR, TS. For interpretations of the Thedalund soil in TS, refer to the Thedalund series. Rock outcrop part of TR is too variable to rate.</p>	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 7 percent in places.	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 8 percent in places.
<p>Trulon. Mapped only with Lap soils.</p>	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 7 percent in places.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches; high or moderate potential frost action.
<p>Tullock: Tu</p>	Severe: bedrock at a depth of 20 to 40 inches.	Severe: rapid permeability; bedrock at a depth of 20 to 40 inches.	Moderate: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.
<p>*Twin Creek: Tv, Tw, Tx, TY. For interpretations of the Korchea soil in TY, refer to the Korchea series.</p>	Moderate: moderate permeability.	Moderate where slopes are less than 7 percent; moderate permeability. Severe where slopes are more than 7 percent.	Slight	Severe: high potential frost action; slopes are more than 8 percent in places.



*properties of the soils—Continued*

Degree and kind of limitations for— Continued		Suitability as a source of—			Soil features affecting—		
Sanitary landfills (trench type) <sup>1</sup>	Roads and parking areas	Road fill	Sand or gravel	Topsoil	Pond reservoir areas	Dams, dikes, and levees	Drainage for crops and pasture
Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 25 percent in places.	Severe: high potential frost action; slopes are more than 15 percent in places.	Poor: high potential frost action; slopes are more than 25 percent in places; bedrock at a depth of 20 to 40 inches.	Not a source.	Fair: less than 16 inches thick.	Bedrock at a depth of 20 to 40 inches.	Medium susceptibility to piping; bedrock at a depth of 20 to 40 inches.	Not applicable.
Moderate: silty clay loam texture.	Severe: high potential frost action; low shear strength.	Poor: high potential frost action; low shear strength.	Not a source.	Fair: silty clay loam texture.	All features favorable.	Moderate shrink-swell potential; low shear strength.	All features favorable.
Severe: very rapid permeability below a depth of 40 inches.	Severe: high potential frost action.	Poor above a depth of 40 inches: high potential frost action. Good below a depth of 40 inches.	Good for gravel and sand below a depth of 40 inches.	Fair: clay loam texture.	Very rapid permeability below a depth of 40 inches.	All features favorable; high compacted permeability below a depth of 40 inches.	All features favorable.
Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Poor: bedrock at a depth of less than 20 inches.	Not a source.	Poor: less than 8 inches thick.	Bedrock at a depth of less than 20 inches.	Medium susceptibility to piping; bedrock at a depth of less than 20 inches.	Not applicable.
Severe: bedrock at a depth of 20 to 40 inches.	Moderate or severe: high or moderate potential frost action; slopes are more than 15 percent in places.	Poor: bedrock at a depth of 20 to 40 inches.	Not a source.	Poor: more than 15 percent coarse fragments.	Bedrock at a depth of 20 to 40 inches.	Medium susceptibility to piping; bedrock at a depth of 20 to 40 inches.	Not applicable.
Severe: bedrock at a depth of 20 to 40 inches.	Moderate: bedrock at a depth of 20 to 40 inches. Severe where slopes are more than 15 percent.	Poor: bedrock at a depth of 20 to 40 inches.	Not a source.	Poor: loose when dry.	Rapid permeability; bedrock at a depth of 20 to 40 inches.	Sandy; rapid permeability; bedrock at a depth of 20 to 40 inches.	Not applicable.
Slight	Severe: high potential frost action; slopes are more than 15 percent in places.	Poor: high potential frost action.	Not a source.	Good	All features favorable.	High piping hazard; low shear strength.	Not applicable.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—			
	Septic-tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements
Vananda: Va, Vc.....	Severe: very slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Severe: clay texture.	Severe: high shrink-swell potential.
Vebar: Vd, Ve, VF, VH, VM..... For interpretations of the Castner soils in VF and VH, refer to the Castner series.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: moderately rapid permeability; bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action; bedrock at a depth of 20 to 40 inches.
Wages: Wa, Wb, Wc.....	Slight.....	Moderate: moderate permeability.	Slight.....	Severe: high potential frost action.
*Wayden: WD, WE, WF, WG, WH, WI, WK, WL, WM, WN, WO. For interpretations of the Arnegard soil in WF, the Grail soil in WG, the Judith soil in WH, the Regent soil in WI, and the Savage soil in WK, refer to the Arnegard, Grail, Judith, Regent, and Savage series, respectively. Rock outcrop parts of WL and WM and Shale outcrop part of WN are too variable to rate.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 7 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: shale at a depth of less than 20 inches; slopes are more than 8 percent in places.
*Wibaux: Wp, Wr..... For interpretations of the Spearman soil in Wr, refer to the Spearman series.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 7 percent.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 8 percent in places.
*Windham: Ws, WT, WU, WV, WW, WX..... For interpretations of the Arnegard soil in WU, the Norbert soil in WV, the Wayden soil in WW, and the Lap soil in WX, refer to the Arnegard, Norbert, Wayden, and Lap series, respectively.	Severe: moderately slow permeability.	Moderate where slopes are 4 to 7 percent. Severe where slopes are more than 7 percent.	Severe: very gravelly.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.
Winnett: Wy.....	Severe: very slow permeability; bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: clay texture; bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches; high shrink-swell potential.
*Xavier: Xa, Xc, Xe, Xh, Xk..... For interpretations of the Shaak soils in Xh and Xk, refer to the Shaak series.	Moderate: moderate permeability.	Moderate where slopes are less than 7 percent; moderate permeability. Severe where slopes are more than 7 percent.	Slight where slopes are 2 to 8 percent. Moderate where slopes are 8 to 15 percent.	Severe: high potential frost action.

<sup>1</sup> Onsite studies of the underlying strata, water table, and hazards of aquifer pollution and drainage into ground water are



*properties of the soils—Continued*

Degree and kind of limitations for— Continued		Suitability as a source of—			Soil features affecting—		
Sanitary landfills (trench type) <sup>1</sup>	Roads and parking areas	Road fill	Sand or gravel	Topsoil	Pond reservoir areas	Dams, dikes, and levees	Drainage for crops and pasture
Severe: clay texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Poor: clay texture; high alkalinity.	All features favorable.	Poor compaction characteristics; high compressibility; low shear strength.	Not applicable.
Severe: moderately rapid permeability; bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action; slopes are more than 15 percent in places.	Poor: high potential frost action; bedrock at a depth of 20 to 40 inches.	Not a source.	Good .....	Moderately rapid permeability; bedrock at a depth of 20 to 40 inches.	Bedrock at a depth of 20 to 40 inches.	Not applicable.
Slight .....	Severe: high potential frost action.	Poor: high potential frost action.	Poor for sand below a depth of 30 inches: excess fines.	Good .....	Moderate permeability.	Moderate shear strength and permeability; high piping hazard.	Unstable ditch banks.
Severe: bedrock at a depth of less than 20 inches; slopes are more than 25 percent in places.	Severe: shale at a depth of less than 20 inches; slopes are more than 15 percent in places.	Poor: shale at a depth of less than 20 inches.	Not a source.	Poor: less than 8 inches thick.	Steep; bedrock at a depth of less than 20 inches.	Moderate shrink-swell potential; bedrock at a depth of less than 20 inches.	Not applicable.
Severe: bedrock at a depth of less than 20 inches; slopes are more than 25 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 8 percent.	Poor: bedrock at a depth of less than 20 inches; slopes are more than 25 percent in places.	Not a source.	Poor: more than 15 percent coarse fragments.	Slopes are more than 8 percent in places; bedrock at a depth of less than 20 inches.	Bedrock at a depth of less than 20 inches.	Not applicable.
Slight where slopes are 4 to 15 percent. Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Good where slopes are 0 to 15 percent. Fair where slopes are 15 to 25 percent. Poor where slopes are more than 25 percent.	Poor for gravel: excess fines.	Poor: more than 15 percent coarse fragments.	Steep; high seepage potential.	High piping hazard; medium compacted permeability.	Not applicable.
Severe: bedrock at a depth of 20 to 40 inches; clay texture.	Severe: high shrink-swell potential; low shear strength.	Fair: bedrock at a depth of 20 to 40 inches; high shrink-swell potential; low shear strength.	Not a source.	Poor: clay texture.	Bedrock at a depth of 20 to 40 inches; moderate seepage potential.	Fair compaction characteristics; bedrock at a depth of 20 to 40 inches.	Not applicable.
Slight .....	Severe: high potential frost action.	Poor: high potential frost action.	Not a source.	Fair: silty clay loam texture.	Slopes are more than 8 percent in places.	High piping hazard; low shear strength.	Not applicable.

needed for landfills more than 5 or 6 feet deep.

used to describe soil reaction are explained in the Glossary.

Shrink-swell potential is the relative change in volume to be expected of soil material with changes in moisture content, that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. The extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils causes much damage to building foundations, roads, and other structures. A *high* shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material that has this rating.

Frost-action potential indicates the suitability of soils for road construction and building sites. A soil that has high frost-action potential is not suitable for these uses unless special design criteria are used to offset the detrimental effects of frost action.

Corrosivity, as used in table 5, pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. Rate of corrosion of uncoated steel is related to such soil properties as drainage, texture, total acidity, and electrical conductivity of the soil material. Corrosivity for concrete is influenced mainly by the content of sodium or magnesium sulfate, but also by soil texture and acidity. Installations of uncoated steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations made entirely in one kind of soil or in one soil horizon. A corrosivity rating of *low* means that there is a low probability of soil-induced corrosion damage. A rating of *high* means that there is a high probability of damage, so that protective measures for steel and more resistant concrete should be used to avoid or minimize damage.

### Engineering interpretations

The estimated interpretations in table 5 are based on the engineering properties of soils shown in table 4, on test data for soils in this survey area and others nearby or adjoining, and on the experience of engineers and soil scientists with the soils of the Big Horn County Area. In table 5, ratings are used to summarize the limitation or suitability of the soils for all listed purposes other than for pond reservoir areas; dams, dikes, and levees; and drainage for crops and pasture. For these particular uses, table 5 lists those soil features not to be overlooked in planning, installation, and maintenance.

Soil limitations are indicated by the ratings slight, moderate, and severe. *Slight* means soil properties are generally favorable for the rated use, or in other words, limitations are minor and easy to overcome. *Moderate* means that some soil properties are unfavorable but can be overcome or modified by special planning and design. *Severe* means soil properties are so unfavorable and so difficult to correct or overcome as to require major soil reclamation and special design. For some uses, the rating of severe is divided to obtain ratings of severe and very severe. *Very severe* means that one or more soil properties are so unfavorable for a particular use that overcoming the limitations is most difficult and costly and commonly not practical for the rated use.

Soil suitability is rated by the terms, *good*, *fair*, and *poor*, which have, respectively, meanings approximately parallel to the terms slight, moderate, and severe.

Following are explanations of the columns in table 5.

Septic-tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material between depths of 18 inches and 6 feet is evaluated. The soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Properties that affect absorption are permeability, depth to water table or rock, and susceptibility to flooding. Slope is a soil property that affects difficulty of layout and construction and also the risk of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs.

Sewage lagoons are shallow ponds constructed to hold sewage within a depth of 2 to 5 feet long enough for bacteria to decompose the solids. A lagoon has a nearly level floor and sides, or embankments, of compacted soil material. The assumptions are made that the embankment is compacted to medium density and that the pond is protected from flooding. Properties that affect the pond floor are permeability, organic matter, and slope: if the floor needs to be leveled, depth to bedrock is important. The soil properties that affect the embankment are the engineering properties of the embankment material as interpreted from the Unified soil classification and the amount of stones, if any, that influence the ease of excavation and compaction of the embankment material.

Shallow excavations are those that require digging or trenching to a depth of less than 6 feet; for example, excavations for pipelines, sewerlines, phone and power transmission lines, basements, open ditches, and cemeteries. Desirable soil properties are good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrops or big stones, and freedom from flooding or a high water table.

Dwellings with basements, as rated in table 5, are not more than three stories high and are supported by foundation footings placed in undisturbed soil. The features that affect the rating of a soil for dwellings are those that relate to capacity to support load and resist settlement under load and those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

Sanitary landfills are areas in which refuse is disposed of in dug trenches. The waste is spread in thin layers, compacted, and covered with soil throughout the disposal period. Landfill areas are subject to heavy vehicular traffic. Some soil properties that affect suitability for landfill are ease of excavation, hazard of polluting ground water, and trafficability. The best soils have moderately slow permeability, withstand heavy traffic, and are friable and easy to excavate. Unless otherwise stated, the ratings in table 5 apply only to a depth of about 6 feet; therefore, limitation



ratings of *slight* or *moderate* may not be valid if trenches are to be much deeper than that. For some soils, reliable predictions can be made to a depth of 10 or 15 feet, but regardless of that, every site should be investigated before it is selected.

Roads and parking areas, as rated in table 5, have an all-weather surface expected to carry automobile traffic all year. They have a subgrade of underlying soil material; a base consisting of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. These roads are graded to shed water and have ordinary provisions for drainage. They are built mainly from soil at hand, and most cuts and fills are less than 6 feet deep.

Soil properties that most affect design and construction of roads and parking areas are load-supporting capacity and stability of the subgrade and the workability and quantity of cut and fill material available. The AASHTO and Unified classifications of the soil material and the shrink-swell potential indicate traffic-supporting capacity. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade.

Road fill is soil material used in embankments for roads. The suitability ratings reflect the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and the relative ease of excavating the material at borrow areas.

Sand or gravel is used in great quantities in many kinds of construction. The ratings in table 5 provide guidance about where to look for probable sources. A soil rated as a *good* or *fair* source of sand or gravel generally has a layer at least 3 feet thick, the top of which is within a depth of 6 feet. The ratings do not take into account thickness of overburden, location of the water table, or other factors that affect mining of the materials. Neither do they indicate the quality of the deposit.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as for preparing a seedbed; natural fertility of the material, or the response of plants when fertilizer is applied; and absence of substances toxic to plants. Texture of the soil material and the content of stone fragments are characteristics that affect suitability, but also considered in the ratings is damage that results at the area from which topsoil is taken.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to permeability and the depth to fractured or permeable bedrock or other permeable material.

Dams, dikes, and levees require soil material that is resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility. Presence of stones or organic material in a soil are among the factors that are unfavorable for this use.

Drainage for crops and pasture is affected by such soil properties as permeability, texture, and structure; depth to claypan, rock, or other layers that influence rate of water movement; depth to the water table; slope; stability in ditchbanks; susceptibility to stream overflow; salinity or alkalinity; and availability of outlets for drainage.

## **Formation and Classification of the Soils**

This section describes the factors that influence soil formation and places the soil series in the higher categories of soil classification.

### **Factors of Soil Formation**

Soil is a product of the interaction of soil-forming processes acting on material deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by the physical and mineral composition of the parent material; the climate under which the soil material has accumulated and existed; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life are active factors of soil formation. They act on parent material through weathering, slowly changing it into a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief and time. Parent material affects the kind of soil. It is the dominant factor in young soils, but its influence generally lessens with soil development. Time is necessary for the formation of a soil, but the length of time required depends upon the other factors of soil formation.

The factors of soil formation are closely interrelated. Few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other factors.

### **Parent material**

Most soils in the Big Horn County Area formed in place over sandstone, siltstone, limestone, and shale bedrock. Some soils formed in alluvium and colluvium derived from sandstone and shale and deposited in major valleys and on bordering highlands. Soils that formed in weathered sandstone, such as those of the Nelson series, are generally sandy. The clay in these soils is from impurities in the sandstone released by weathering. Soils that formed in shale, such as those in the Pierre series, are clayey because clay is the basic constituent of shale. Soils that formed in mixed alluvium derived from sandstone and shale, such as those of the McRae series, are loamy. Soils that formed in limestone, such as those of the Lap series, are high in content of calcium carbonate. Many soils in the Area acquired salt and sodium from their parent material. Excess salt and sodium in the soil limit the kind and amount of plants that can grow on them. The density of the parent rock and its mineral composition can limit the rate of weathering and the depth of the soil, as in the shallow Rentsac soils.



### **Climate**

Climate, an active force in the formation of soils, is determined mainly by temperature and precipitation. Erosion and alternate freezing and thawing break rocks down into material in which soils form. Water and wind are active agents in transporting and separating weathered material. The weathered material is further broken down by chemical reactions, such as solution and hydration. In this Area precipitation ranges from 11 to 24 inches. In the dry and warm northern part of the Area are Aridisols, such as those in the Cushman and Fort Collins series. In cooler, wetter parts of the Area are Mollisols, such as those in the Reeder series.

Temperature and the amount of distribution of precipitation also influence the kind and amount of vegetation that grows on the soil.

### **Living organisms**

Living organisms also are active in the formation of soils. Organic matter is the main source of the dark color of the surface layer of soils. Fungi and algae are among the earliest inhabitants of rock material, contribute to the decomposition of rocks. As the rocks decompose, grasses, shrubs, and trees are able to grow and support animal life.

The kinds of plants and animals present largely determines that kind and amount of organic matter added to the soil and how this material is distributed within the mineral part of the soil. Roots, rodents, and insects penetrate the soil and influence its structure and permeability. Leaves, roots, and whole plants remain in the surface layer, where they are changed to humus by micro-organisms, chemicals in the soil, and insects.

The vegetation in the Big Horn County Area ranges from short and mid grasses, forbs, and shrubs in most areas to ponderosa pine, juniper, cedar, aspen, spruce, and fir in the Pryor, Big Horn, Wolf, and Rosebud Mountains. Common rodents are gophers, prairie dogs, badgers, rabbits, and marmots. Many of the pebbles and stones on the surface of terraces and other areas were dug up by burrowing rodents.

### **Relief**

Relief, or topography, is determined by the uplift of mountain masses and the resistance of bedrock to erosion by water and wind. In the eroded highlands of the Area, runoff water has carved into the original bedrock deep valleys that have many branches. The rugged relief of the mountains contrasts sharply with the smooth, low relief of the terraces and flood plains of the river valleys.

In the highlands the number and the distinctness of soil horizons decrease as slope increases. Steep soils on which runoff is rapid have many characteristics that are similar to those of soils that formed in arid climates. Level soils that receive runoff water from soils above them have many characteristics of soils that formed in a more humid climate. An example of this pattern is the Thedalund-Cushman soil complex. Thedalund loam, occupying the convex slopes of ridges, has only a thin A horizon overlying a C horizon. Cush-

man loam, in swales between ridges, has an A horizon and a 7-inch B2t horizon and is leached of lime to a depth of 10 inches.

### **Time**

The soils of the Big Horn County Area vary in age. The time available for a soil to form in unconsolidated sediments is the time that has elapsed since the last sediments were deposited. Soils on sedimentary rocks began to develop after the parent rock weathered into permeable material. The age, or maturity, of a soil is generally indicated by the thickness and distinctness of the subsurface horizons. The effect of time on soil formation can be modified greatly by the other factors of soil formation, particularly relief and parent material.

Haverson loam, a soil of the Entisol order, is an example of a youthful soil. It is also in a young geomorphic position on a flood plain adjacent to a flowing stream, where it receives additional soil material during periods of stream overflow. The soil contains little organic matter from which to form an A horizon; it has no evidence of clay weathering, translocation, and accumulation; and little translocation of carbonates has occurred.

Farnuf soils formed in similar parent material to Haverson silty clay loam, but on much older geomorphic surfaces. Farnuf soils are mature soils of the Mollisol order. They contain enough organic matter to have a dark A horizon. They have a distinct subsurface B2t horizon of clay accumulation, and carbonates have been leached to a depth of 18 inches or more.

### **Classification of the Soils**

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The narrow categories that are used in detailed soil surveys allow us to organize and apply knowledge about the soils in managing farms, fields, and woodland; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

The system of soil classification currently used was adopted for general use by the National Cooperative Soil Survey in 1965. The current system is under continual study. Therefore, readers interested in developments of the current system should search the latest literature available (9, 11). In table 6, the soil series of the Big Horn County Area are placed in some categories of the current system.

The current system of classification has six categories. Beginning with the broadest, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. In this system the criteria used as a basis for classification are soil



TABLE 6.—Soils classified according to the current system of classification

Series	Family	Subgroup	Order
Abac	Loamy, mixed (calcareous), frigid, shallow	Typic Ustorthents	Entisols.
Absarokee	Fine, montmorillonitic	Typic Argiborolls	Mollisols.
Absher	Fine, montmorillonitic	Borollic Natrargids	Aridisols.
Adel	Fine-loamy, mixed	Pachic Cryoborolls	Mollisols.
Adger	Fine, montmorillonitic	Typic Natriborolls	Mollisols.
Alice	Coarse-loamy, mixed, mesic	Aridic Haplustolls	Mollisols.
Allentine	Fine, montmorillonitic, mesic	Haplustollic Hatrargids	Aridisols.
Amherst	Clayey, montmorillonitic	Lithic Argiborolls	Mollisols.
Armington	Very fine, mixed	Vertic Haploborolls	Mollisols.
Arnegard	Fine-loamy, mixed	Pachic Haploborolls	Mollisols.
Arvada	Fine, montmorillonitic, mesic	Ustollic Natrargids	Aridisols.
Ascalon	Fine-loamy, mixed, mesic	Aridic Argiustolls	Mollisols.
Babb	Fine-loamy, mixed	Typic Cryoborolls	Mollisols.
Beauvais	Fine-silty, mixed, mesic	Aridic Argiustolls	Mollisols.
Belfield	Fine, montmorillonitic	Glossic Natriborolls	Mollisols.
Benteen	Fine-loamy, mixed	Argic Pachic Cryoborolls	Mollisols.
Bew	Fine, montmorillonitic, mesic	Ustollic Haplargids	Aridisols.
Bittou	Loamy-skeletal, mixed	Entic Haploborolls	Mollisols.
Bone	Fine, montmorillonitic (calcareous), mesic	Ustic Torriorthents	Entisols.
Castner <sup>1</sup>	Loamy-skeletal, mixed	Lithic Haploborolls	Mollisols.
Cherry	Fine-silty, mixed, frigid	Typic Ustochrepts	Inceptisols.
Chugter	Fine-loamy, mixed, mesic	Aridic Haplustolls	Mollisols.
Clapper	Loamy-skeletal, mixed, mesic	Ustollic Calciorthids	Aridisols.
Colby	Fine-silty, mixed (calcareous), mesic	Ustic Torriorthents	Entisols.
Cushman	Fine-loamy, mixed, mesic	Ustollic Haplargids	Aridisols.
Danvers	Fine, montmorillonitic	Typic Argiborolls	Mollisols.
Darret	Fine, mixed	Typic Argiborolls	Mollisols.
Dast	Coarse-loamy, mixed (calcareous), frigid	Typic Ustorthents	Entisols.
Doney	Fine-loamy, mixed (calcareous), frigid	Typic Ustorthents	Entisols.
Duncom <sup>2</sup>	Loamy, mixed	Lithic Cryoborolls	Mollisols.
Elsac	Very-fine, montmorillonitic (calcareous), frigid.	Vertic Ustorthents	Entisols.
Farnuf	Fine-loamy, mixed	Typic Argiborolls	Mollisols.
Fergus	Fine, mixed	Typic Argiborolls	Mollisols.
Fort Collins	Fine-loamy, mixed, mesic	Ustollic Haplargids	Aridisols.
Frazer	Fine, montmorillonitic	Fluventic Haploborolls	Mollisols.
Gilt Edge	Fine, montmorillonitic, mesic	Haplustollic Natrargids	Aridisols.
Glenberg	Coarse-loamy, mixed (calcareous), mesic	Ustic Torrifluents	Entisols.
Graill	Fine, montmorillonitic	Pachic Argiborolls	Mollisols.
Hanson	Loamy-skeletal, carbonatic	Calcic Cryoborolls	Mollisols.
Harvey	Fine-loamy, mixed, mesic	Ustollic Calciorthids	Aridisols.
Haverson	Fine-loamy, mixed (calcareous), mesic	Ustic Torrifluents	Entisols.
Heldt	Fine, montmorillonitic, mesic	Ustertic Camborthids	Aridisols.
Hesper	Fine, montmorillonitic, mesic	Ustollic Haplargids	Aridisols.
Hydro	Fine, montmorillonitic, mesic	Glossic Ustollic Natrargids	Aridisols.
Hysham	Fine-loamy, mixed (calcareous), mesic	Ustic Torrifluents	Entisols.
Judith	Fine-loamy, carbonatic	Typic Calciborolls	Mollisols.
Keiser	Fine-silty, mixed, mesic	Ustollic Haplargids	Aridisols.
Kim	Fine-loamy, mixed (calcareous), mesic	Ustic Torriorthents	Entisols.
Korchea	Fine-loamy, mixed (calcareous), frigid	Typic Ustifluents	Entisols.
Kyle	Very fine, montmorillonitic, mesic	Ustertic Camborthids	Aridisols.
La Fonda	Fine-loamy, mixed, mesic	Ustollic Camborthids	Aridisols.
Lap	Loamy-skeletal, carbonatic	Lithic Calciborolls	Mollisols.
Lavina	Clayey, montmorillonitic, mesic	Aridic Lithic Argiustolls	Mollisols.
Lennepe	Fine, montmorillonitic	Glossic Natriborolls	Mollisols.
Lismas	Clayey, montmorillonitic (calcareous), mesic, shallow.	Ustic Torriorthents	Entisols.
Lohmiller	Fine, montmorillonitic (calcareous), mesic	Ustic Torrifluents	Entisols.
Macar	Fine-loamy, mixed, frigid	Typic Ustochrepts	Inceptisols.
Maginnis	Clayey-skeletal, montmorillonitic	Lithic Haploborolls	Mollisols.

TABLE 6.—*Soils classified according to the current system of classification—Continued*

Series	Family	Subgroup	Order
Marias <sup>a</sup>	Fine, montmorillonitic (calcareous), frigid	Ustertic Torriorthents	Entisols.
Maschetah	Fine-silty, mixed	Typic Calciborolls	Mollisols.
Mayflower	Fine, montmorillonitic	Argic Pachic Cryoborolls	Mollisols.
McKenzie	Fine, montmorillonitic (calcareous), frigid	Typic Haplaquepts	Inceptisols.
McRae	Fine-loamy, mixed, mesic	Ustollic Camborthids	Aridisols.
Midway	Clayey, montmorillonitic (calcareous), mesic, shallow.	Ustic Torriorthents	Entisols.
Morton	Fine-silty, mixed	Typic Argiborolls	Mollisols.
Nelson	Coarse-loamy, mixed (calcareous), mesic	Ustic Torriorthents	Entisols.
Neville	Fine-loamy, mixed (calcareous), mesic	Ustic Torriorthents	Entisols.
Nobe	Fine, montmorillonitic (calcareous), frigid	Ustic Torriorthents	Entisols.
Norbert	Clayey, montmorillonitic (calcareous), frigid, shallow.	Typic Ustorthents	Entisols.
Nunn	Fine, montmorillonitic, mesic	Aridic Argiustolls	Mollisols.
Olney	Fine-loamy, mixed, mesic	Ustollic Haplargids	Aridisols.
Parshall	Coarse-loamy, mixed	Pachic Haploborolls	Mollisols.
Peritsa	Fine-silty, mixed	Typic Haploborolls	Mollisols.
Pierre	Very fine, montmorillonitic, mesic	Ustertic Camborthids	Aridisols.
Pultney	Fine-loamy, mixed, mesic	Ustollic Calciorthids	Aridisols.
Quietus	Fine-loamy, mixed	Boralfic Cryoborolls	Mollisols.
Raynesford	Fine-loamy, carbonatic	Calcic Cryoborolls	Mollisols.
Reeder	Fine-loamy, mixed	Typic Argiborolls	Mollisols.
Regent	Fine, montmorillonitic	Typic Argiborolls	Mollisols.
Renohill	Fine, montmorillonitic, mesic	Ustollic Haplargids	Aridisols.
Rentsac	Loamy-skeletal, mixed (calcareous), frigid	Lithic Ustic Torriorthents	Entisols.
Richfield	Fine, montmorillonitic, mesic	Aridic Argiustolls	Mollisols.
Ringling	Loamy-skeletal, mixed	Lithic Haploborolls	Mollisols.
Rottulee	Fine-loamy, mixed	Typic Haploborolls	Mollisols.
Ryorp	Coarse-loamy, mixed	Typic Cryochrepts	Inceptisols.
Savage	Fine, montmorillonitic	Typic Argiborolls	Mollisols.
Sawcreek	Coarse-loamy, mixed	Typic Cryoborolls	Mollisols.
Searing	Fine-loamy, mixed	Typic Haploborolls	Mollisols.
Shaak	Fine, montmorillonitic	Abruptic Argiborolls	Mollisols.
Shonkin	Fine, montmorillonitic, mesic	Glossic Natraqualls	Alfisols.
Sofia	Fine, montmorillonitic, mesic	Aridic Argiustolls	Mollisols.
Spearfish	Loamy, mixed (calcareous), mesic, shallow	Ustic Torriorthents	Entisols.
Spearman	Fine-loamy, mixed, mesic	Aridic Haplustolls	Mollisols.
Splitro	Loamy, mixed	Lithic Cryoborolls	Mollisols.
Stormitt	Loamy-skeletal, carbonatic, mesic	Ustollic Calciorthids	Aridisols.
Talag	Fine, montmorillonitic, mesic	Glossic Ustollic Natrargids	Aridisols.
Tarrete	Very fine, mixed	Vertic Cryoborolls	Mollisols.
Terry	Coarse-loamy, mixed, mesic	Ustollic Haplargids	Aridisols.
Teton	Fine-loamy, mixed	Typic Cryoborolls	Mollisols.
Thedalund	Fine-loamy, mixed (calcareous), mesic	Ustic Torriorthents	Entisols.
Thurlow	Fine, montmorillonitic, mesic	Ustollic Haplargids	Aridisols.
Toluca	Fine-loamy, mixed, mesic	Ustollic Haplargids	Aridisols.
Travessilla	Loamy, mixed (calcareous), mesic	Lithic Ustic Torriorthents	Entisols.
Trulon	Fine-loamy, carbonatic	Typic Calciborolls	Mollisols.
Tullock	Mixed, mesic	Ustic Torripsamments	Entisols.
Twin Creek	Fine-loamy, mixed	Typic Haploborolls	Mollisols.
Vananda	Fine, montmorillonitic (calcareous), mesic	Ustic Torriorthents	Entisols.
Vebar	Coarse-loamy, mixed	Typic Haploborolls	Mollisols.
Wages	Fine-loamy, mixed, mesic	Aridic Argiustolls	Mollisols.
Wayden	Clayey, mixed (calcareous), frigid, shallow	Typic Ustorthents	Entisols.
Wibaux	Loamy-skeletal over fragmental, mixed, nonacid, mesic.	Ustic Torriorthents	Entisols.
Windham	Loamy-skeletal, carbonatic	Typic Calciborolls	Mollisols.
Winnett	Fine, montmorillonitic, mesic	Ustollic Natrargids	Aridisols.
Xavier	Fine-silty, mixed	Typic Argiborolls	Mollisols.

<sup>1</sup>Castner soils as mapped in the Big Horn County Area are taxadjuncts to the Castner series. They are classified as a member of the coarse-loamy, mixed family of Lithic Haploborolls.

<sup>2</sup>Duncom soils as mapped in the Big Horn County Area are taxadjuncts to the Duncom series. They are classified as a member of the loamy-skeletal, carbonatic family of Lithic Cryoborolls.

<sup>3</sup>Marias soils as mapped in the Big Horn County Area are taxadjuncts to the Marias series. They are classified as a member of the fine, montmorillonitic (calcareous), frigid family of Vertic Ustorthents.



properties that are observable and measurable. The properties are chosen, however, so that soils of similar genesis, or mode of origin, are grouped together. Most of the classes of the current system are defined briefly in the following paragraphs.

**ORDER.**—Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are Entisols and Histosols, which occur in many different climates. Table 6 shows that the five soil orders in the Big Horn County Area are Entisols, Inceptisols, Aridisols, Mollisols, and Alfisols.

*Entisols* are light-colored soils that do not have natural genetic horizons or that have only weakly expressed beginnings of such horizons. These soils do not have traits that reflect soil mixing caused by shrinking and swelling.

*Inceptisols* are light-colored soils that have only weakly expressed genetic horizons and are moist more than half of the time they are not frozen.

*Aridisols* are light-colored mineral soils that are high in bases and that have well-expressed mineral genetic horizons.

*Mollisols* are soils that formed under grass and have a thick, dark-colored surface horizon that contains colloids dominated by bivalent cations. The soil material in these soils has not been mixed by shrinking and swelling.

*Alfisols* are mineral soils that contain horizons of clay accumulation. Unlike Mollisols, they do not have a thick, dark-colored surface layer that contains colloids dominated by bivalent cations, but the base status of the lower horizons is not extremely low.

**SUBORDER.**—Each order has been divided into suborders, mainly on the basis of the characteristics that seem to produce classes that have the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging or soil differences that result from climate or vegetation.

**GREAT GROUP.**—Suborders are separated into great groups on the basis of uniformity in the kind and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus has accumulated; those that have a pan that interferes with growth of roots, movement of water, or both; and those that are thick, dark-colored surface horizon. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), and the like. The great group is not shown separately in table 6, because it is the last word in the name of the subgroup.

**SUBGROUP.**—Great groups are divided into subgroups, one that represents the central (typic) segment of the group, and others, called intergrades, that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups can also be made in those instances where soil properties intergrade outside the range of any great group, suborder, or order. The names of sub-

groups are derived by placing one or more adjectives in front of the great group.

**FAMILY.**—Families are established within a subgroup, mainly on the basis of properties that are important to the growth of plants or behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistency.

## General Nature of the Area

The Big Horn County Area received its first foreign visitor in 1743, Chavalier de la Verendrye, who sought a route to the Pacific. In 1804 explorers surveyed fur resources in the Area. Captain Clark and party, of the Lewis and Clark Expedition, passed eastward on the Yellowstone River in 1806. Fort Manual Lisa, a fur-trading post, was established at the mouth of the Big Horn River in 1807. Except for a few fur traders and an occasional gold prospector, the Area was rarely visited by white men until the opening of the Bozeman Trail in 1864. Many miners and settlers passed over this trail. It crossed the foot slopes of the Big Horn Mountains, crossed the Big Horn River near the mouth of Big Horn Canyon, and continued westward across the foot slopes of the Pryor Mountains.

Fort C. F. Smith was built in 1866 to protect the fort across the river. The Indians resented this intrusion, and the Government temporarily appeased them by abandoning the fort in 1868 and ordering the miners and settlers to keep out of the Area. Disregarding this agreement, the miners and settlers continued to encroach on Indian territory, and the Indians resisted until 1876, when Federal troops were sent to control them. In the ensuing campaign, General George A. Custer and his entire troop were killed at the Battle of the Little Big Horn. The Custer Battlefield National Monument is located about 3 miles south of Crow Agency. After this reversal, the Government took effective action against the Indians. In 1877, Fort Custer was built on the bluffs overlooking the Big Horn and Little Big Horn Valleys, about 3 miles southeast of the present site of Hardin. The fort was maintained as a cavalry post until 1902.

From 1880 to 1890, soon after the danger of the Indian raids had passed, the first permanent settlers came to the Area. They were cattlemen who established headquarters adjacent to the Wolf, Rosebud, and Big Horn Mountains. These early ranches were operated by companies that had herds of as many as 30,000 head. In 1901 sheep raising had its beginning when large, company-owned flocks were brought into the Area to graze. About this time the entire Crow Indian Reservation was leased by one sheep outfit. In 1904 the Indian lands adjacent to the Yellowstone River and the land in the lower Big Horn Valley were ceded to the Federal Government, and they were opened to homesteading in 1906. Within a few years, a large acreage was taken up by settlers. Dryland farming prospered from 1906 to 1917 under conditions of abnormally high rainfall and high prices. During

later years, drought caused repeated failures, and dryland farming decreased.

In 1885 the Reno unit of the Crow Indian Project was constructed. It was the earliest irrigation development in the Area. Other irrigation projects, both Federal and private, were started in the 1890's. At present 17 major canals serve the irrigation projects in the Area.

The proposed Hardin Unit, under study by the Bureau of Reclamation, is designed to irrigate an additional 45,000 acres. It is located on the west side of the Big Horn River on what is locally known as the Hardin Bench. It is a strip of land 2 to 3 miles wide that extends from 6 miles north of Hardin to an area near the mouth of the Big Horn Canyon. Several small tracts of land east of the Big Horn River are included in the project.

The Crow Indian Reservation was established by an Act of Congress in 1868. Its present size is 2,119,530 acres, of which about 220,000 acres is in Yellowstone County. In the irrigated valleys about 40 percent of the land has been sold to non-Indian farmers. Small tracts of dry cropland and range have also been sold. Most of the land is rough range that is leased by the Indians to cattle ranches in the Area. A large area of dry cropland is on the gravelly benches west of the Big Horn River. This area includes the land proposed for irrigation under the Hardin Unit, and much of it is leased by the Campbell Farming Corporation. There is an area, about township size, of dry cropland on the gravelly bench between the Little Big Horn and Big Horn Rivers south of Hardin.

Hardin, the principal town of the Big Horn County Area and the county seat of Big Horn County, was settled in 1907. Crow Agency is the headquarters of the Crow Indian Reservation. The population of Big Horn county was 9,328 in 1950 and 10,057 in 1970. In 1970, 4,035 Crow Indians lived in the county.

In 1969, according to the U.S. Census of Agriculture, there were about 515 farms in the Area. Of these, 256 were irrigated. Tables 7 and 8 show, respectively, the numbers of selected kinds of livestock on farms in the Area and the acreage and yields of principal crops.

TABLE 7.—Numbers of selected kinds of livestock on farms in stated years

[Data from Montana Agricultural Statistics, v. XIII, Dec. 1970]

Livestock	1968	1969	1970
All cattle and calves .....	112,000	107,000	116,000
Cows 2 years old and older			
kept for milk .....	600	500	500
Sheep and lambs .....	15,000	15,000	15,000
Chickens .....	13,000	12,900	12,600
Hogs and pigs .....	11,000	10,000	9,019
Horses .....	—	2,934	—

From its central location in the Area, Hardin serves as the wheat and feed-grain marketing terminal. Three elevators, with a combined storage capacity of nearly 1 million bushels, serve the Area. Cattle are shipped by truck and rail from Hardin, Lodge Grass, and Wyola.

Natural gas pipelines supply heating fuel to all the towns and villages in the Area. Electric power is generated at the Yellowtail Dam for distribution to surrounding States.

A branch line of the Burlington Northern Railroad connects the Area with Billings, Montana, and Lincoln, Nebraska. Interstate Highway 90, presently under construction, enters the Area south of Wyola, follows the Little Big Horn River Valley to Hardin, then proceeds towards Billings, Montana, in a northwest direction. Highway 47 connects Hardin with Interstate Highway 94 just north of the county boundary. Highway 212 joins Interstate 90 only 1 mile south of Crow Agency and follows an easterly route into Rosebud County. Paved secondary roads connect Hardin with Pryor, Yellowtail Dam, and Sarpy Creek. Construction has begun on a road between St. Xavier and Pryor.

A carpet mill and a livestock feed processing mill are located on the Crow Indian Reservation.

Cash receipts from livestock and livestock products in 1969 were \$11,194,800, and from crops, \$5,793,900.

Oil is produced in the Snyder field east of Hardin, the Soap Creek field near Yellowtail Dam, and the

TABLE 8.—Acreage and yields of principal crops

[All data for 1969. Source: Montana Agricultural Statistics, v. XIII]

Crop	Acres—		Yield per harvested acre	Irrigated—		Nonirrigated—	
	planted	harvested		acres harvested	yield per acre	acres harvested	yield per acre
Winter wheat .....	58,500	53,124	27.2 bu	1,600	36.0 bu	51,524	26.9 bu
Durum wheat .....	300	200	29.0 bu	100	40.0 bu	100	18.0 bu
Other spring wheat .....	1,900	1,800	32.4 bu	1,000	36.0 bu	800	26.6 bu
Oats .....	6,600	5,500	48.5 bu	1,900	59.0 bu	3,600	43.0 bu
Barley .....	19,800	18,000	36.2 bu	3,800	42.7 bu	14,200	34.5 bu
Alfalfa hay .....	—	43,000	1.94 tons	22,200	2.55 tons	20,800	1.30 tons
Wild hay .....	—	2,100	1.14 tons	400	1.25 tons	1,700	1.12 tons
Alfalfa seed .....	—	2,300	93 lb	1,000	155 lb	1,300	45 lb
Sugar beets .....	12,700	12,500	17.6 tons	12,500	17.6 tons	—	—
Dry beans .....	700	700	15 cwt	700	15 cwt	—	—



Ash Creek field west of Decker. Crude oil production in 1969 was 110,770 barrels. The Hardin gas field supplies natural gas for local use.

Subbituminous coal is strip mined at Decker. A second mine is being opened on Sarpy Creek east of Hardin. Strippable reserves of coal are estimated at more than 3 trillion tons.

Timberland is generally in the ownership of the Crow Indian tribe. Several small contracts for logging have been let in the Pryor Mountains in recent years. Timber has been harvested on several privately owned ranches in the past 5 years.

Betonite deposits south of Wyola are mined on a small scale.

Sand and gravel deposits on terraces along the river valleys are used locally for road building and masonry structures.

### Climate<sup>5</sup>

Elevation within the Area ranges from as high as 9,000 feet or more above sea level on some mountain peaks in the southern half to about 2,700 feet where the Big Horn River leaves the Area north of Hardin, and its effects on climate are significant. The Area as a whole has a modified continental climate; but within that general climate type, mountain effects on temperature and precipitation patterns have a wide range. Winter snowfall in the higher mountains along the Wyoming border, for example, is much greater than in most parts of the survey area, reaching a depth of 100 inches or more on some slopes before the snow begins to melt in spring. These mountain snowfields usually have a stabilizing influence on animal water supplies.

To a large extent, climate is a determining factor in the use of the land. Valley bottoms are warm enough to permit a well-developed farming system, particularly where water for irrigation is plentiful. Sugar beets, corn for silage, alfalfa hay, dry beans, winter wheat, oats, and barley are the major crops grown under irrigation. Above the valley bottoms are several ranches. Because of the limited growing season, these ranches produce winter wheat, barley, and some alfalfa hay. The ranches are generally combination dry-farmed crops-beef cattle operations.

The longest growing season in the Area is on the fairly level plains around Hardin, where the 32° freeze-free season averages 125 days and the 28° freeze-free season, 151 days, indicating a favorable regime for sugar beets, corn, alfalfa hay, dry beans, winter wheat, oats, and barley. At higher elevations, in most cases, production of dryfarmed wheat and cattle ranching are the major farm enterprises.

The Area is subject to air masses from several sources. During winter the coldest weather comes from a few Arctic air invasions, supplanted in each case a few days later by warmer air from the Pacific—sometimes borne on chinook (Foehn) winds. Spring and early summer are the wettest parts of the year. The heaviest rain is during storms from the Gulf of

Mexico, mostly in May and June. Midsummer afternoon thunderstorms occur about 25 to 35 days a year, sometimes accompanied by hail and gusty winds. Damage to crops from hail, however, seldom is widespread, even though some hail falls somewhere in the Area almost every year.

The combination of precipitation early in the growing season—from two-thirds to three-fourths of the yearly average falls between April 1 and September 30—with rapid warming of the temperature in May and June has helped to produce a stable farming system in the arable sections of the Area.

Various data from climate records in the Big Horn County Area are summarized in tables 9 through 15. These tables have been prepared to emphasize the important differences from place to place within the Area. Hardin, for example, represents the drier, warmer northern part; Wyola, the foothills of the south; and Busby and Crow Agency, the hilly country of the southeast. A limited record at a station up the Big Horn River from St. Xavier, near the present site of Yellowtail Dam, indicates a climate there somewhat similar to that around Wyola, but perhaps a little wetter.

### Physiography, Relief, and Drainage

The Big Horn County Area is in the unglaciated part of the Missouri Plateau section of the Great Plains physiographic province. It is adjacent to the mountains at the west edge of the plains. The broader physiographic aspect of the Area is that valleys emerge from the mountains and cross the plains to the north and east. Except for the Big Horn and Pryor Mountains, the Area has the appearance of mature dissection. The side stream drainageways are separated by relatively narrow but somewhat rounded divides. The divides rise 500 to 1,000 feet above the bottoms of the Big Horn, Little Big Horn, and Tongue Rivers; however, the difference in elevation between the side streams and the divides is only about half this amount. In the Big Horn and Little Big Horn Valleys are nearly level bottom lands and low terraces. Above these is a series of higher terraces at different levels, representing the various stages of entrenchment and temporary base leveling by the present or former streams. West of the Big Horn River, the terraces are at five distinct levels. They are mantled with gravelly mountain sediment, valley fill, loess, and reworked old alluvium. These materials are underlain at varying depth by shale and sandstone of the Colorado and Montana geologic groups.

The Big Horn Mountains rise sharply in the southern part of the Area to elevations of more than 9,000 feet above sea level. The Pryor Mountains cover about 3 townships in the southwestern corner of the Area. Garvin Basin, an area of about 70,000 acres, lies in a trough between the Big Horn and Pryor Mountains. The Big Horn Canyon, now filled with the waters held by Yellowtail Dam, traverses the basin. The Rosebud Mountains, in the southeastern part of the Area, rise abruptly to elevations of more than 5,000 feet. They are separated from the Wolf Mountains to the north by a narrow divide near the junction of Davis Creek

<sup>5</sup> By R. A. DIGHTMAN, meteorologist for Montana, National Weather Service, U.S. Department of Commerce.

TABLE 9.—*Temperature and precipitation*

[Data from Busby, Montana. Elevation 3,500 feet. Period of record 1937–66]

Month	Temperature					Precipitation							
	Average daily maximum	Average daily minimum	Average monthly highest temperature	Average monthly lowest temperature	Average monthly total	1 year in 10 will have:		2 years in 10 will have:		3 years in 10 will have:		4 years in 10 will have:	
						Less than—	More than—	Less than—	More than—	Less than—	More than—	Less than—	More than—
	°F	°F	°F	°F	In	In	In	In	In	In	In	In	In
January .....	32	3	49	—26	0.5	0.1	1.2	0.1	0.7	0.2	0.5	0.3	0.5
February .....	37	8	56	—19	.4	.1	.8	.2	.6	.2	.5	.3	.5
March .....	44	17	66	—11	.6	.2	1.2	.3	.9	.4	.7	.5	.6
April .....	59	29	79	13	1.2	.3	2.6	.6	2.0	.7	1.5	.9	1.3
May .....	69	38	87	24	2.1	.8	3.9	1.1	3.2	1.5	2.7	1.6	2.2
June .....	77	46	93	33	2.5	1.2	4.0	1.4	3.5	1.6	3.4	2.0	2.7
July .....	89	52	102	40	1.2	.1	2.7	.3	2.1	.6	1.5	.9	1.3
August .....	88	49	101	36	1.1	.1	3.0	.1	1.9	.3	1.4	.4	1.1
September .....	76	40	92	24	1.1	.2	2.3	.3	2.0	.5	1.5	.7	1.2
October .....	65	30	85	16	.8	.1	1.8	.4	1.5	.5	.9	.6	.9
November .....	46	18	67	— 6	.6	.1	1.2	.2	.9	.2	.8	.4	.8
December .....	37	10	57	—18	.5	.1	1.0	.2	.8	.3	.6	.3	.5
Year .....	60	28	<sup>1</sup> 103	<sup>2</sup> —33	12.6	9.1	16.4	10.2	15.8	11.0	14.7	11.7	13.6

<sup>1</sup>Average annual highest temperature.<sup>2</sup>Average annual lowest temperature.TABLE 10.—*Temperature and precipitation*

[Data from Crow Agency. Elevation 3,030 feet. Period of record 1937–66]

Month	Temperature					Precipitation							
	Average daily maximum	Average daily minimum	Average monthly highest temperature	Average monthly lowest temperature	Average monthly total	1 year in 10 will have:		2 years in 10 will have:		3 years in 10 will have:		4 years in 10 will have:	
						Less than—	More than—	Less than—	More than—	Less than—	More than—	Less than—	More than—
	°F	°F	°F	°F	In	In	In	In	In	In	In	In	In
January .....	34	5	54	—24	0.6	0.1	1.1	0.2	1.0	0.3	0.8	0.4	0.6
February .....	40	11	59	—17	.6	.2	1.1	.4	.8	.5	.7	.5	.7
March .....	48	19	70	— 8	1.0	.4	2.1	.5	1.6	.5	1.3	.6	.8
April .....	62	30	81	15	1.8	.4	5.1	.6	3.1	.8	1.9	1.1	1.5
May .....	72	40	89	27	2.0	.9	4.0	1.2	2.9	1.3	2.2	1.5	2.1
June .....	79	48	95	36	2.8	.8	5.1	1.2	4.2	1.7	3.9	1.8	3.3
July .....	91	53	103	42	.8	.1	1.8	.2	1.5	.4	1.2	.5	.9
August .....	89	50	102	39	1.1	.1	2.1	.3	1.9	.6	1.3	.6	1.1
September .....	77	41	95	27	1.4	.2	4.1	.3	1.9	.4	1.7	1.1	1.3
October .....	68	31	86	18	1.1	.1	2.5	.4	1.7	.5	1.3	.7	1.2
November .....	49	19	69	— 3	.7	.1	1.5	.2	1.3	.4	.9	.5	.8
December .....	40	11	61	—15	.6	.1	1.3	.2	1.1	.3	1.1	.4	.9
Year .....	62	30	<sup>1</sup> 104	<sup>2</sup> —29	14.5	10.1	19.5	10.6	17.9	12.3	15.9	13.5	15.3

<sup>1</sup>Average annual highest temperature.<sup>2</sup>Average annual lowest temperature.

and Rosebud Creek. In the northwestern part of the Area is a range of rough hills, called the Pine Ridge, that are partly mantled by gravelly remnants of an ancient stream terrace.

### Geology and Ground Water

About 12,000 feet of sedimentary rocks, predominantly of marine origin, are exposed in the Area. They represent every geologic period except the Silurian. Pre-Cambrian crystalline rocks are exposed only in the deepest part of the Big Horn Canyon. All information

in this section is presented in Geological Survey Water Supply Paper 1487 (8).

*Quaternary alluvium and lower terrace deposits.*—The youngest sediments are on fans and valley bottoms of rivers. The most extensive deposits occur in the valleys of the Big Horn and Little Big Horn Rivers. Ground water from the Little Big Horn River Valley is generally suitable for domestic and livestock use but is unsuitable for domestic use in the Big Horn River Valley.

*Other terrace deposits.*—The alluvial deposits on high terraces are generally drained of ground water,



TABLE 11.—*Temperature and precipitation*

[Data from Hardin, Montana. Elevation 2,885 feet. Period of record 1941–66]

Month	Temperature				Precipitation								
	Average daily maxi- mum	Average daily mini- mum	Average monthly highest temper- ature	Average monthly lowest temper- ature	Average monthly total	1 year in 10 will have:		2 years in 10 will have:		3 years in 10 will have:		4 years in 10 will have:	
						Less than—	More than—	Less than—	More than—	Less than—	More than—	Less than—	More than—
	°F	°F	°F	°F	In	In	In	In	In	In	In	In	In
January .....	33	5	55	—22	0.5	0.2	0.9	0.2	0.8	0.3	0.6	0.3	0.5
February .....	39	12	60	—15	.4	.1	.9	.2	.6	.3	.6	.3	.5
March .....	46	19	70	— 9	.6	.2	1.1	.3	.9	.4	.8	.4	.7
April .....	61	31	81	17	1.2	.2	3.4	.4	2.0	.6	1.4	.7	1.1
May .....	71	41	89	27	1.6	.7	2.6	.9	2.5	1.0	2.2	1.5	1.7
June .....	78	49	95	37	2.8	.7	5.5	1.0	4.3	1.5	3.6	2.0	3.2
July .....	90	54	102	44	.9	.2	2.1	.3	1.5	.4	1.1	.5	1.0
August .....	88	52	101	40	1.0	.2	2.2	.4	1.8	.4	1.4	.5	1.0
September .....	75	42	94	29	1.5	.1	3.0	.3	2.3	.4	1.8	.9	1.6
October .....	65	31	84	17	.7	.1	1.7	.2	1.2	.3	1.0	.4	1.0
November .....	47	20	68	1	.6	.1	1.1	.1	.9	.3	.7	.3	.6
December .....	38	11	59	—15	.5	.1	1.0	.2	.9	.2	.7	.2	.6
Year .....	61	31	<sup>1</sup> 103	<sup>2</sup> —29	12.3	8.0	16.6	8.7	14.9	10.3	13.6	10.8	13.0

<sup>1</sup>Average annual highest temperature.<sup>2</sup>Average annual lowest temperature.TABLE 12.—*Temperature and precipitation*

[Data from Wyola, Montana. Elevation 3,705 feet. Period of record 1937–66]

Month	Temperature				Precipitation								
	Average daily maximum	Average daily minimum	Average monthly highest temperature	Average monthly lowest temperature	Average monthly total	1 year in 10 will have:		2 years in 10 will have:		3 years in 10 will have:		4 years in 10 will have:	
						Less than—	More than—	Less than—	More than—	Less than—	More than—	Less than—	More than—
	°F	°F	°F	°F	In	In	In	In	In	In	In	In	In
January .....	36	8	58	—20	0.7	0.1	1.6	0.3	1.0	0.4	0.9	0.4	0.9
February .....	40	12	61	—15	.7	.3	1.2	.5	1.0	.5	.8	.6	.7
March .....	46	19	68	— 8	1.0	.5	2.0	.5	1.6	.5	1.3	.6	1.0
April .....	60	30	79	15	2.0	.7	4.3	.9	2.6	1.3	2.4	1.5	2.1
May .....	69	39	87	26	2.4	1.2	3.9	1.5	3.3	1.7	3.0	1.8	2.4
June .....	77	46	93	33	2.6	.9	4.9	1.1	4.1	1.5	3.0	1.6	2.6
July .....	88	51	101	41	1.0	.1	2.2	.1	1.6	.4	1.4	.5	1.2
August .....	88	49	101	38	.9	.1	1.8	.3	1.5	.6	1.3	.6	1.1
September .....	75	40	94	26	1.4	.2	3.1	.3	2.7	.5	1.4	.7	1.2
October .....	66	32	85	17	1.2	.1	1.9	.4	1.6	.5	1.5	.7	1.4
November .....	48	20	69	— 3	.8	.2	1.8	.3	1.3	.5	1.0	.5	.8
December .....	41	14	62	—12	.7	.2	1.4	.3	1.0	.4	.9	.4	.8
Year .....	61	30	<sup>1</sup> 102	<sup>2</sup> —26	15.4	9.6	20.0	11.7	19.6	12.9	17.5	13.7	16.6

<sup>1</sup>Average annual highest temperature.<sup>2</sup>Average annual lowest temperature.

except near the middle of the more extensive remnants, or where there are springs along the bases of terrace escarpments. Gravel beds range from 10 to 30 feet in thickness.

**Wasatch Formation.**—The Wasatch Formation consists of interbedded light-gray sandy shale, sandstone, dark-gray clay shale. The fine-grained sandstone member is the ledge-forming rock along deep valleys near the crest of the Rosebud Mountains and in areas east of Decker. It is generally drained of water, but springs occur at the base in the Roland coal bed. The Wasatch Formation is about 350 feet thick in these areas.

**Fort Union Formation.**—The Fort Union Formation is divided into the Tullock member at the base, the Lebo shale member in the middle, and the Tongue River member at the top. The Tongue River member is interbedded light-gray sandy shale and sandstone that is 850 to 1,800 feet thick. Coal beds are common, including clinker beds that result from burning coal. Sandstone is more conspicuous than the shale because it is more resistant to weathering. The Lebo shale member consists of sandy shale, siltstone, and arkosic sandstone 150 to 300 feet thick. It is distinguished by its content of volcanic ash and ironstone and its bar-

TABLE 13.—Average precipitation in inches

[Length of record: at Decker and Lodge Grass, 17 years; at Pryor, 16 years; at Kirby, 7 years]

Month	Decker	Kirby	Lodge Grass	Pryor
January .....	0.3	1.1	0.7	0.6
February .....	.3	1.2	.7	.6
March .....	.4	.9	1.0	.8
April .....	1.2	2.0	1.8	2.4
May .....	1.7	2.1	2.0	2.6
June .....	2.1	2.6	2.7	2.1
July .....	1.0	.9	1.1	.8
August .....	1.2	1.5	1.0	1.3
September .....	.9	1.6	1.5	1.2
October .....	.8	.8	1.2	1.0
November .....	.5	.9	.9	.8
December .....	.4	1.0	.7	.5
Year .....	10.8	16.6	15.3	14.7

ren slopes. It tends to weather to badland topography and clay soil. The Tullock member, about 300 feet thick, consists of interbedded dark-gray shale and sandy shale and brownish-colored sandstone. Exposed sections have a banded appearance of yellowish gray and bright yellowish gray. Coal beds are common, but they are generally thin. The sandstone of the Tullock member is a reliable source of water.

**Hell Creek Formation.**—The Hell Creek Formation is Cretaceous rock that is 600 to 650 feet thick. It consists of interbedded dark-gray sandy shale and sandstone and olive-gray shale. It is darker than the overlying Tullock member but lighter than the underlying Bearpaw Formation. Thick, massive lenses of sandstone are common but generally can be traced for only a short distance. This formation yields only small quantities of water and contains more minerals than the overlying formations.

**Bearpaw Shale Formation.**—The Bearpaw Shale Formation is largely dark-gray, marine, fossiliferous shale 850 to 1,100 feet thick that has numerous brownish-colored, weathering, calcareous concretions and much bentonite in the middle part. It contains little water and is highly mineralized.

**Judith River Formation.**—The upper part of this formation is 700 feet of light-colored, interbedded

sandy shale and sandstone. Near the Wyoming-Montana line the beds consist of massive, brown and gray sandstone interbedded with green and light brownish-gray sandy shale and dark-gray shale and a few coal beds just above the Parkman member. The lower Parkman sandstone member, 250 to 350 feet thick, is brownish colored and is typically soft but has harder, brownish-colored, weathering, concretionary sandstone that contains limonitic nodules. The town of Lodge Grass obtains its municipal water supply from the Parkman sandstone. Wells that tap the basal sandstone yield good quantities of potable water. The water is more mineralized north of Hardin, where the Parkman sandstone is interfingered with the overlying Bearpaw Shale.

**Cody Shale Formation.**—The upper part of the Cody Shale Formation is the Claggett member, 350 to 650 feet thick. It is dark-gray marine shale that weathers to reddish brown. It contains two beds of grayish-yellow bentonite near the base and calcareous concretions throughout that weather to light brown. Below the Claggett member is a 375-foot-thick member equivalent to Eagle Sandstone. It is mostly dark-gray sandy shale that has ferruginous concretions and weathers to brownish gray. The Telegraph Creek member, 780 to 870 feet thick, is mostly buff-colored sandy shale that has a few thin beds of sandstone and calcareous concretions. The Niobrara Shale is about 400 feet thick and crops out in the northern and central parts of the Area. It consists of dark-gray marine shale, many thin beds of bentonite, and several beds of septarian concretions. Carlile Shale, about 280 feet thick, is mostly dark-gray marine shale that weathers to light gray and has numerous fossiliferous, calcareous, septarian concretions and several beds of bentonite near the base. The Greenhorn calcareous member is 50 to 100 feet thick. It is dark-gray, very calcareous, marine shale that weathers to nearly white and has light-gray or buff limestone concretions. Limonitic-stained bentonite that is 1 foot thick marks the base. The base of the Cody Shale is concretionary, dark-gray shale 200 feet thick that has several thin beds of sandstone in the lower part. Water supply in the Cody Shale is limited to a small amount of mineralized water from the sandy part of the Claggett

TABLE 14.—Average snowfall in inches

Month	Busby	Crow Agency	Hardin	Kirby	Pryor	Wyola
January .....	6	7	7	13	12	11
February .....	6	7	5	21	10	12
March .....	8	8	7	10	13	11
April .....	4	5	2	8	13	9
May .....	1	<sup>1</sup> T	T	T	1	1
June .....	<sup>1</sup> T	T	T	0	0	T
July .....	0	0	0	0	0	0
August .....	0	0	0	0	0	0
September .....	1	1	1	2	1	1
October .....	2	2	1	T	4	2
November .....	6	5	3	11	8	10
December .....	7	9	8	14	9	10
Year .....	41	44	34	79	71	67

<sup>1</sup>T = trace.



TABLE 15.—Probabilities of last freezing temperatures in spring and first in fall

Probability	Station	Dates for given probability and temperature		
		24° F or lower	28° F or lower	32° F or lower
Spring:				
1 year in 10 later than:	Busby .....	May 17	May 28	June 12
	Crow Agency.....	May 10	May 20	June 4
	Hardin .....	May 8	May 19	June 3
	Wyola .....	May 12	June 2	June 20
2 years in 10 later than:	Busby .....	May 12	May 23	June 7
	Crow Agency.....	May 4	May 14	May 28
	Hardin .....	May 2	May 13	May 28
	Wyola .....	May 6	May 26	June 14
5 years in 10 later than:	Busby .....	May 2	May 13	May 28
	Crow Agency.....	April 22	May 2	May 17
	Hardin .....	April 22	May 3	May 18
	Wyola .....	April 24	May 14	June 2
Fall:				
1 year in 10 earlier than:	Busby .....	September 17	September 8	August 30
	Crow Agency.....	September 28	September 13	September 2
	Hardin .....	October 1	September 15	September 4
	Wyola .....	September 29	September 14	September 1
2 years in 10 earlier than:	Busby .....	September 22	September 13	September 4
	Crow Agency.....	October 4	September 19	September 8
	Hardin .....	October 6	September 20	September 9
	Wyola .....	October 3	September 19	September 6
5 years in 10 earlier than:	Busby .....	October 2	September 23	September 14
	Crow Agency.....	October 15	September 30	September 19
	Hardin .....	October 16	October 1	September 19
	Wyola .....	October 12	September 28	September 15

member and from the equivalent to the Eagle sandstone.

**Frontier Formation.**—The Frontier Formation, about 260 feet thick, consists of mostly dark-gray, concretionary sandy shale and interbedded bentonite. It has a few lenses of sandstone, some of which are mostly small, black chert fragments of pebble size. The Soap Creek bentonite bed at the top is 5 to 10 feet thick over much of the area. Water is yielded in small amounts in the upper part.

**Mowry Shale.**—The Mowry Shale, 345 to 400 feet thick, consists of dark-gray shale and light-gray siltstone and sandstone. Some of the shale and much of the siltstone is hard and resistant to erosion because it is siliceous. The siliceous beds weather to light gray and light bluish gray. Fishscale impressions are characteristic of this formation. Water is present in small amounts and is mineralized.

**Thermopolis Shale.**—This formation consists of about 425 feet of dark-gray shale and many beds of bentonite and ironstone concretions. Three or four bentonite beds near the middle are 2 to 4 feet thick. Between 150 and 200 feet from the base, the shale is cut by sandstone dikes that are 1 inch to 8 inches thick and 5 to 15 feet or more long. This nearly impermeable shale contains little water.

**Cloverly Formation.**—The Cloverly Formation generally consists of 300 to 400 feet of a discontinuous basal conglomeritic sandstone member; a middle variegated shale member; and an upper shale, siltstone, and sandstone member. The lower member, or

Pryor Conglomerate, ranges from 30 to 150 feet in thickness; the middle part ranges from a few feet to 140 feet thick; and the upper unit is about 250 feet thick along the east side of the Big Horn Mountains and consists of interbedded siltstone, dark-gray shale, and thinly bedded sandstone. The Cloverly Formation yields a moderate to large supply of water to wells that tap the lower part of the formation. The water is mineralized but is usable for domestic purposes. In favorable topographic locations artesian flow is possible.

**Morrison Formation.**—The Morrison Formation consists of 140 to 280 feet of grayish-green siltstone, sandstone, and variegated shale. Some lower beds are cross bedded and calcareous. It yields a small quantity of water from the more permeable strata.

**Swift Formation.**—The Swift Formation, 90 to 250 feet thick, consists of grayish-green sandstone, siltstone, and shale. In places the sandstone contains glauconite, chert pebbles, and fossil shells. Water is yielded in small quantities.

**Rierdon Formation.**—This formation consists of 175 to 390 feet of nonresistant, calcareous, light-brown shale over gray shale. At the top is a 5- to 10-foot bed of sandy, oolitic, fossiliferous, ledge-forming limestone. It is underlain by 5 to 10 feet of highly calcareous, yellowish-gray, very fine grained sandstone. This unit forms ridges, in contrast to the otherwise smooth slopes of the Rierdon and Swift Formations. Little, if any, water is present.

**Piper Formation.**—This formation consists of about 150 feet of red sandstone and siltstone and gray lime-



stone and gypsum. The lower 45 feet is thickly bedded gypsum and layers of red and green shale; the middle part is gray argillaceous limestone interbedded with green and red shale; and the upper member consists of red shale and siltstone. Any water from this formation is highly mineralized.

**Chugwater Formation.**—This formation is 375 to 650 feet thick. It consists largely of red sandstone, mostly fine grained to very fine grained and medium red to dark red. Red siltstone and shale are interbedded with the sandstone in small amounts. Also, there are stringers of gypsum and some limestone. No water is in this relatively impermeable formation.

**Tensleep Sandstone.**—The Tensleep Sandstone is 175 to 220 feet thick. The upper part is thinly bedded limestone, dolomite, shale, siltstone, and sandstone. The lower 75 to 120 feet is light-gray to yellowish-brown crossbedded sandstone and a little interbedded limestone and dolomite. The sandstone contains well-rounded, fine-grained to medium-grained quartz sand. Groves of pine trees mark outcrops of Tensleep Sandstone on the mountain slopes. This formation yields a moderate to large amount of water to wells that tap the thick sections of the formation. Most of the water is fresh.

**Amsden Formation.**—The Amsden Formation consists of 230 to 280 feet of interbedded sandstone, limestone, and red shale and siltstone. The Amsden Formation is separated from the underlying Madison Limestone by an erosional unconformity. This formation yields a large quantity of water from the brecciated or cavernous limestone.

**Madison Limestone.**—This formation, 670 to 800 feet thick, consists of massive, light-gray limestone and dolomite that form prominent cliffs and canyon walls. It is the most prolific water-bearing formation underlying the Area. However, the water is mineralized, and the formation is at a great depth except in the Big Horn and Pryor Mountains.

**Jefferson Limestone and Three Forks Shale. Undifferentiated.**—These formations consist of 180 to 200 feet of limestone, dolomite, and greenish-gray shale, siltstone, and sand. The upper part is very sandy limestone and dolomite.

**Big Horn Dolomite.**—This formation, 200 to 500 feet thick, consists of a lower massive dolomitic limestone member and an upper thinly bedded dolomitic and limestone member.

**Gallatin Limestone and Gros Ventre Shale. Undifferentiated.**—This formation, about 700 feet thick, consists of limestone and shale of Cambrian age. It crops out in the deepest part of Big Horn Canyon.

The Pre-Cambrian crystalline rocks that form the core of the Big Horn Mountains are exposed only at Point Lookout, 16 miles south of the mouth of Big Horn Canyon.

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## Glossary

**Alkali soil.** Generally, a highly alkaline soil. Specifically, an alkali soil has so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that the growth of most crop plants is low from this cause.

**Alluvium.** Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

**Available water capacity** (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

**Calcareous soil.** A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

**Clay.** As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

**Clay film.** A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

**Consistence, soil.** The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

**Loose.**—Noncoherent when dry or moist; does not hold together in a mass.

**Friable.**—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

**Firm.**—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

**Plastic.**—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

**Sticky.**—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

**Hard.**—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

**Soft.**—When dry, breaks into powder or individual grains under very slight pressure.

**Cemented.**—Hard and brittle; little affected by moistening.



**Depth, soil.** Depth to a layer that restricts movement of water and roots. Depth classes recognized in this survey are:

	Inches
Shallow .....	less than 20
Moderately deep .....	20-40
Deep .....	more than 40

**Flood plain.** Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

**Horizon, soil.** A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

**O horizon.**—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

**A horizon.**—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

**B horizon.**—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

**C horizon.**—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

**R layer.**—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

**Permeability.** The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid and very rapid.*

**pH value.** A numerical means for designating acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

**Reaction, soil.** The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

pH		pH	
Extremely acid .....	Below 4.5	Neutral .....	6.6 to 7.3
Very strongly acid .....	4.5 to 5.0	Mildly alkaline .....	7.4 to 7.8
Strongly acid .....	5.1 to 5.5	Moderately alkaline .....	7.9 to 8.4
Medium acid .....	5.6 to 6.0	Strongly alkaline .....	8.5 to 9.0
Slightly acid .....	6.1 to 6.5	Very strongly alkaline .....	9.1 and higher

**Relief.** The elevations or inequalities of a land surface, considered collectively.

**Saline soil.** A soil that contains soluble salts in amounts that impair growth of plants but that does not contain excess exchangeable sodium.

**Sand.** Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

**Silt.** Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

**Slope class.** The slope classes used in this survey are:

	Percent
Nearly level .....	0-2
Gently sloping (undulating) .....	2-8
Strongly sloping (sloping or rolling) .....	8-15
Moderately steep (hilly) .....	15-25
Steep .....	25-45
Very steep .....	More than 45

**Soil.** A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

**Structure, soil.** The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles) adhering together without any regular cleavage, as in many claypans and hardpans).

**Terrace.** An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

**Texture, soil.** The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

**Topsoil.** A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

**Upland.** (geology). Land consisting of material unworked by water in recent geologic time and lying, in general, at a higher elevation than the alluvial plain or stream terrace. Land above the lowlands along rivers.

# GUIDE TO MAPPING UNITS

For complete information about a mapping unit, read both the description of the mapping unit and that of the series to which it belongs. Explanations of capability units begin on page 122, of range sites on page 134, and of windbreak suitability groups on page 143.

Map symbol		Mapping unit	Page	Capability unit		Range site	Windbreak suitability group
Low intensity	Medium intensity			Irrigated	Dryland		
				Symbol	Symbol	Name	Symbol
	Aa	Abac loam, rolling-----	13	-----	VIe-1	Silty, 15- to 19-inch precipitation zone	3M
AB		Abac loam, hilly-----	14	-----	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
AC		Abac-Bitton complex, hilly-----	14	-----	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
AD		Abac-Rock outcrop complex, very steep-----	14	-----	VIIe-1	Thin Breaks, 15- to 19-inch precipitation zone	4
	Ae	Absarokee silty clay loam, gently undulating-----	15	-----	IIe-2	Clayey, 15- to 19-inch precipitation zone	2M
	Af	Absarokee silty clay loam, undulating-----	15	-----	IIIe-2	Clayey, 15- to 19-inch precipitation zone	2M
	Ag	Absarokee silty clay loam, rolling-----	15	-----	IVe-2	Clayey, 15- to 19-inch precipitation zone	2M
AH		Absarokee silty clay loam, hilly-----	15	-----	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
	Ak	Absarokee-Castner complex, undulating-----	15	-----	VIIs-1	Shallow, 15- to 19-inch precipitation zone	4
AL		Absarokee-Castner complex, hilly---	15	-----	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
AM		Absarokee-Armington association, gently sloping-----	15	-----	IIIe-2	Clayey, 15- to 19-inch precipitation zone	2M
	An	Absher-Nobe clays-----	16	-----	VIIs-1	Pan Spots, 15- to 19-inch precipitation zone	3S
AO		Adel-Mayflower association, sloping-----	17	-----	IVe-2	Silty, 20- to 24-inch precipitation zone	1
	Ap	Adger clay, 0 to 8 percent slopes--	17	-----	VIIs-1	Clayey, 15- to 19-inch precipitation zone	3S
	Ar	Alice fine sandy loam, 4 to 15 percent slopes-----	18	-----	IIIe-3	Sandy, 10- to 14-inch precipitation zone	2M
	Asa	Allentine clay, 0 to 2 percent slopes-----	19	IVs-1	VIIs-1	Clayey, 10- to 14-inch precipitation zone	2S
	Asb	Allentine clay, 2 to 4 percent slopes-----	19	IVs-1	VIIs-1	Clayey, 10- to 14-inch precipitation zone	2S
	Asc	Allentine-Bone complex, 0 to 1 percent slopes-----	19	IVs-1	VIIs-1	Pan Spots, 10- to 14-inch precipitation zone	3S
	Asd	Allentine-Bone complex, 1 to 4 percent slopes-----	19	-----	VIIs-1	Pan Spots, 10- to 14-inch precipitation zone	3S
ATa		Alluvial land, gravelly-----	19	-----	VIIs-1	Shallow to Gravel, 10- to 14-inch precipitation zone	4



## GUIDE TO MAPPING UNITS--Continued

Map symbol		Mapping unit	Page	Capability unit		Range site	Windbreak suitability group
Low intensity	Medium intensity			Irrigated	Dryland		
Symbol	Symbol			Symbol	Symbol	Name	Symbol
ATb		Alluvial land, cobbly-----	19	-----	VIIs-1	Shallow to Gravel, 15- to 19-inch precipitation zone	3M
ATc		Alluvial land, wet-----	19	-----	IVw-2	Wet Land, 15- to 19-inch precipitation zone	3W
	Au	Amherst loam, undulating-----	20	-----	IVe-2	Silty, 15- to 19-inch precipitation zone	3M
AVa		Amherst loam, rolling-----	20	-----	IVe-2	Silty, 15- to 19-inch precipitation zone	3M
AVb		Amherst complex, rolling-----	20	-----	VIe-1	Silty, 15- to 19-inch precipitation zone	3M
AVc		Amherst complex, hilly-----	20	-----	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
AVd		Amherst-Maginnis complex, hilly--	20	-----	VIIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
AWa		Armington silty clay loam-----	21	-----	IVe-2	Clayey, 15- to 19-inch precipitation zone	2M
AWb		Armington complex, rolling-----	21	-----	IVe-2	Clayey, 15- to 19-inch precipitation zone	2M
	Axa	Arnegard loam, 8 to 15 percent slopes-----	22	-----	IVe-2	Silty, 15- to 19-inch precipitation zone	1
	Axb	Arnegard silt loam, 2 to 4 percent slopes-----	22	IIe-1	IIe-2	Silty, 15- to 19-inch precipitation zone	1
	Axc	Arnegard silt loam, 4 to 8 percent slopes-----	22	-----	IIIe-2	Silty, 15- to 19-inch precipitation zone	1
	Ayd	Arvada silty clay loam-----	23	-----	VIIs-1	Clayey, 10- to 14-inch precipitation zone	3S
	Aye	Arvada-Bone clays-----	23	-----	VIIs-1	Pan Spots, 10- to 14-inch precipitation zone	4
	Az	Ascalon sandy loam, 4 to 8 percent slopes-----	23	-----	IIIe-2	Sandy, 10- to 14-inch precipitation zone	2M
BA		Babb silt loam, rolling $\frac{1}{2}$ -----	24	-----	IVe-2	-----	--
BB		Babb silt loam, hilly $\frac{1}{2}$ -----	24	-----	VIe-1	-----	--
	Bc	Beauvais silty clay loam, gently undulating-----	25	IIe-1	IIe-2	Silty, 15- to 19-inch precipitation zone	1
	Bd	Beauvais silty clay loam, undulating-----	25	IIIe-1	IIIe-2	Silty, 15- to 19-inch precipitation zone	1
	Be	Beauvais silty clay loam, rolling-----	25	IVe-2	IVe-2	Silty, 15- to 19-inch precipitation zone	1
	Bf	Beauvais-Gilt Edge silty clay loams, gently undulating-----	25	IIe-1	IIe-2	Clayey, 15- to 19-inch precipitation zone	2S
	Bg	Belfield silt loam, 0 to 1 percent slopes-----	26	IIIs-1	IIIs-2	Silty, 15- to 19-inch precipitation zone	1
	Bh	Belfield silt loam, gently undulating-----	26	IIe-1	IIe-2	Silty, 15- to 19-inch precipitation zone	1
	Bk	Belfield silt loam, undulating---	26	IIIe-1	IIIe-2	Silty, 15- to 19-inch precipitation zone	1

## GUIDE TO MAPPING UNITS--Continued

Map symbol		Mapping unit	Page	Capability unit		Range site	Windbreak suitability group
Low inten-sity	Medium inten-sity			Irrigated	Dryland		
				Symbol	Symbol	Name	Symbol
	Bm	Belfield-Adger complex, 0 to 1 percent slopes-----	26	-----	IIe-2	Pan Spots, 15- to 19-inch precipitation zone	3S
	Bn	Belfield-Adger complex, gently undulating-----	26	-----	IIe-2	Pan Spots, 15- to 19-inch precipitation zone	3S
	Bo	Belfield-Adger complex, undulating-----	26	-----	IIIe-2	Pan Spots, 15- to 19-inch precipitation zone	3S
	Bp	Benteen loam, rolling-----	27	-----	VIe-1	Silty, 20- to 24-inch precipitation zone	1
	Br	Benteen loam, hilly-----	27	-----	VIe-1	Silty, 20- to 24-inch precipitation zone	1
	Bs	Bew silty clay loam, 0 to 1 percent slopes-----	28	IIIs-1	IIIs-3	Clayey, 10- to 14-inch precipitation zone	1
	Bt	Bew silty clay loam, gently undulating-----	28	IIIe-1	IIIe-3	Clayey, 10- to 14-inch precipitation zone	1
BU		Bitton gravelly loam, 2 to 8 percent slopes-----	28	-----	IVs-2	Silty, 15- to 19-inch precipitation zone	3M
BV		Bitton soils, hilly-----	28	-----	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
	Bw	Bone clay-----	29	-----	VIIIs-1	Dense Clay, 10- to 14-inch precipitation zone	4
CA		Castner-Reeder loams, undulating--	30	-----	VIe-1	Shallow, 15- to 19-inch precipitation zone	3M
CB		Castner-Reeder loams, rolling----	30	-----	VIe-1	Shallow, 15- to 19-inch precipitation zone	3M
CC		Castner-Rock outcrop complex, rolling-----	30	-----	VIe-1	Shallow, 15- to 19-inch precipitation zone	4
CD		Castner-Vebar sandy loams, hilly--	30	-----	VIe-1	Sandy, 15- to 19-inch precipitation zone	4
	Ce	Cherry silty clay loam, 2 to 8 percent slopes-----	30	IIIe-1	IIIe-2	Clayey, 15- to 19-inch precipitation zone	1
	Cf	Chugter loam, 2 to 8 percent slopes-----	31	IIIe-1	IIIe-3	Silty, 10- to 14-inch precipitation zone	1
CG		Chugter complex, 2 to 15 percent slopes-----	31	-----	IVe-3	Silty, 10- to 14-inch precipitation zone	1
CH		Clapper-Harvey complex, rolling---	32	-----	VIIs-1	Silty, 10- to 14-inch precipitation zone	3L
CK		Clapper-Midway complex, hilly----	32	-----	VIe-1	Thin Hilly, 10- to 14-inch precipitation zone	4
	Cm	Colby silt loam, 4 to 8 percent slopes-----	33	IIIe-1	IIIe-3	Silty, 10- to 14-inch precipitation zone	1
	Cn	Colby silt loam, 8 to 15 percent slopes-----	33	IVe-2	IVe-3	Silty, 10- to 14-inch precipitation zone	1
	Co	Colby silty clay loam, 1 to 4 percent slopes-----	33	IIe-1	IIIe-2	Clayey, 10- to 14-inch precipitation zone	1



## GUIDE TO MAPPING UNITS--Continued

Map symbol		Mapping unit	Page	Capability unit		Range site	Windbreak suitability group
Low intensity	Medium intensity			Irrigated	Dryland		
				Symbol	Symbol	Name	Symbol
	Cp	Colby silty clay loam, 4 to 8 percent slopes-----	33	IIIe-1	IIIe-3	Clayey, 10- to 14-inch precipitation zone	1
	Cr	Colby silty clay loam, 8 to 15 percent slopes-----	33	IVe-2	IVe-3	Clayey, 10- to 14-inch precipitation zone	1
	Cs	Colby-Beauvais silt loams, undulating-----	33	IIIe-1	IIIe-3	Silty, 10- to 14-inch precipitation zone	1
	Ct	Colby-Beauvais silt loams, rolling-----	33	IVe-2	IVe-3	Silty, 10- to 14-inch precipitation zone	1
CU		Colby-Clapper silt loams, rolling--	34	-----	IVe-3	Silty, 10- to 14-inch precipitation zone	3L
	Cv	Colby-Keiser silty clay loams, 4 to 8 percent slopes-----	34	IIIe-1	IIIe-3	Silty, 10- to 14-inch precipitation zone	1
CW		Colby-Midway complex, 8 to 15 percent slopes-----	34	-----	IVe-3	Clayey, 10- to 14-inch precipitation zone	3M
CX		Colby association, rolling-----	34	-----	IVe-3	Silty, 10- to 14-inch precipitation zone	3M
CY		Colby association, hilly-----	34	-----	VIe-1	Thin Hilly, 10- to 14-inch precipitation zone	4
	Cz	Cushman loam, undulating-----	35	-----	IIIe-3	Silty, 10- to 14-inch precipitation zone	3M
	Da	Danvers silty clay loam, 0 to 1 percent slopes-----	35	IIc-1	IIc-2	Clayey, 15- to 19-inch precipitation zone	2L
	Db	Danvers silty clay loam, gently undulating-----	36	IIe-1	IIe-2	Clayey, 15- to 19-inch precipitation zone	2L
	Dc	Danvers silty clay loam, undulating-----	36	IIIe-1	IIIe-2	Clayey, 15- to 19-inch precipitation zone	2L
	Dd	Danvers cobbly silty clay loam, 1 to 4 percent slopes-----	36	-----	IIe-2	Clayey, 15- to 19-inch precipitation zone	2L
	De	Danvers-Judith silty clay loams, gently undulating-----	36	-----	IIe-2	Clayey, 15- to 19-inch precipitation zone	3L
	Df	Danvers-Judith silty clay loams, undulating-----	36	-----	IIIe-2	Clayey, 15- to 19-inch precipitation zone	3L
	Dg	Danvers-Judith silty clay loams, hilly-----	36	-----	IVe-2	Thin Hilly, 15- to 19-inch precipitation zone	3L
DHa		Dast sandy loam, rolling-----	37	-----	IVe-2	Sandy, 15- to 19-inch precipitation zone	3M
DHb		Dast sandy loam, hilly-----	37	-----	VIe-1	Sandy, 15- to 19-inch precipitation zone	4
DHc		Dast complex, hilly-----	37	-----	VIe-1	Sandy, 15- to 19-inch precipitation zone	4
DHd		Dast complex, very steep-----	38	-----	VIIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
	Dk	Dast-Parshall sandy loams, rolling-----	38	-----	IVe-2	Sandy, 15- to 19-inch precipitation zone	3M

## GUIDE TO MAPPING UNITS--Continued

Map symbol		Mapping unit	Page	Capability unit		Range site	Windbreak suitability group
Low intensity	Medium intensity			Irrigated	Dryland		
				Symbol	Symbol	Name	Symbol
DMa		Doney loam, rolling-----	38	-----	IVe-2	Silty, 15- to 19-inch precipitation zone	3M
DMb		Doney silty clay loam, hilly-----	38	-----	VIe-1	-----	--
	Dn	Doney-Reeder loams, rolling-----	39	-----	IVe-2	Silty, 15- to 19-inch precipitation zone	3M
DOa		Doney-Ringling complex, rolling----	39	-----	VIe-1	Silty, 15- to 19-inch precipitation zone	4
DOb		Doney-Ringling complex, hilly-----	39	-----	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
DOc		Doney-Ringling complex, very steep-----	39	-----	VIIe-1	Thin Breaks, 15- to 19-inch precipitation zone	4
DOd		Doney-Rock outcrop complex, very steep-----	39	-----	VIIe-1	Thin Breaks, 15- to 19-inch precipitation zone	4
DOe		Doney-Wayden complex, hilly-----	40	-----	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
	Dp	Duncom extremely channery loam, rolling-----	40	-----	VIe-1	Shallow, 20- to 24-inch precipitation zone	4
DR		Duncom complex, rolling-----	40	-----	VIIs-1	Shallow, 20- to 24-inch precipitation zone	4
DS		Duncom-Tarrete association, rolling-----	40	-----	VIe-1	Shallow, 20- to 24-inch precipitation zone	4
DT		Duncom-Tarrete association, hilly--	41	-----	VIe-1	Shallow, 20- to 24-inch precipitation zone	4
	Ec	Eltzac clay, undulating-----	41	-----	IIIe-2	Clayey, 15- to 19-inch precipitation zone	3M
	Ed	Eltzac clay, rolling-----	41	-----	IVe-2	Clayey, 15- to 19-inch precipitation zone	3M
EH		Eltzac cobbly clay, hilly-----	41	-----	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
	Fa	Farnuf loam, 0 to 2 percent slopes-----	42	IIc-1	IIc-2	Silty, 15- to 19-inch precipitation zone	1
	Fb	Farnuf loam, 2 to 4 percent slopes-----	42	IIe-1	IIe-2	Silty, 15- to 19-inch precipitation zone	1
	Fc	Farnuf loam, 4 to 8 percent slopes-----	42	IIIe-1	IIIe-2	Silty, 15- to 19-inch precipitation zone	1
FD		Farnuf-Doney association, sloping--	42	-----	IVe-2	Silty, 15- to 19-inch precipitation zone	2M
	Fe	Fergus silt loam, 2 to 4 percent slopes-----	43	-----	IIIe-2	Silty, 15- to 19-inch precipitation zone	1
	Ff	Fergus silt loam, 4 to 8 percent slopes-----	43	-----	IIIe-2	Silty, 15- to 19-inch precipitation zone	1
	Fg	Fergus silt loam, 8 to 15 percent slopes-----	43	-----	IVe-2	Silty, 15- to 19-inch precipitation zone	1
	Fh	Fort Collins loam, 0 to 2 percent slopes-----	44	IIc-1	IIIc-1	Silty, 10- to 14-inch precipitation zone	1
	Fk	Fort Collins loam, 2 to 4 percent slopes-----	44	IIe-1	IIIe-3	Silty, 10- to 14-inch precipitation zone	1



## GUIDE TO MAPPING UNITS--Continued

Map symbol		Mapping unit	Page	Capability unit		Range site	Windbreak suitability group
Low inten-	Medium inten-			Irrigated	Dryland		
sity	sity			Symbol	Symbol	Name	Symbol
	Fm	Fort Collins loam, 4 to 8 percent slopes-----	44	IIIE-1	IIIE-3	Silty, 10- to 14-inch precipitation zone	1
	Fn	Fort Collins loam, channeled, 4 to 8 percent slopes-----	44	-----	IVe-3	Silty, 10- to 14-inch precipitation zone	1
	Fo	Frazer silty clay loam-----	45	IIS-1	IIe-2	Clayey, 15- to 19-inch precipitation zone	1
	Fr	Frazer silty clay loam, saline-----	45	-----	IIIS-2	Saline Lowland, 10- to 14-inch precipitation zone	2S
	Fs	Frazer silty clay-----	45	IIS-1	IIs-2	Clayey, 15- to 19-inch precipitation zone	1
FT		Frazer and Korchea soils, channeled-----	45	-----	VIe-1	Silty, 10- to 14-inch precipitation zone	4
	Gc	Gilt Edge silty clay loam, 0 to 2 percent slopes-----	46	IVs-1	IVs-2	Dense Clay, 10- to 14-inch precipitation zone	2S
	Gd	Gilt Edge silty clay loam, 2 to 4 percent slopes-----	46	IVe-1	IVs-2	Dense Clay, 10- to 14-inch precipitation zone	2S
	Ge	Gilt Edge-Bone complex, 0 to 1 percent slopes-----	46	IVs-1	IVs-2	Pan Spots, 10- to 14-inch precipitation zone	4
	Gf	Gilt Edge-Bone complex, 1 to 4 percent slopes-----	46	IVe-1	IVs-2	Pan Spots, 10- to 14-inch precipitation zone	4
	Gg	Glenberg fine sandy loam, 0 to 2 percent slopes-----	47	IIS-2	IVe-3	Sandy, 10- to 14-inch precipitation zone	2M
	Gh	Glenberg fine sandy loam, 2 to 4 percent slopes-----	47	IIe-2	IVe-3	Sandy, 10- to 14-inch precipitation zone	2M
	Gk	Glenberg fine sandy loam, 4 to 8 percent slopes-----	47	IIIE-2	IVe-3	Sandy, 10- to 14-inch precipitation zone	2M
	Gm	Glenberg loam, 0 to 2 percent slopes-----	47	IIS-2	IVe-3	Silty, 10- to 14-inch precipitation zone	1
	Gn	Graill clay loam, 0 to 2 percent slopes-----	48	IIS-1	IIc-2	Clayey, 15- to 19-inch precipitation zone	1
	Go	Graill clay loam, 2 to 8 percent slopes-----	48	IIIE-1	IIIE-2	Clayey, 15- to 19-inch precipitation zone	1
	Gr	Graill clay loam, 8 to 15 percent slopes-----	48	-----	IVe-2	Clayey, 15- to 19-inch precipitation zone	1
GS		Graill clay loam, 15 to 35 percent slopes-----	48	-----	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
	Gt	Graill silty clay, 0 to 2 percent slopes-----	48	IIS-1	IIIE-2	Clayey, 15- to 19-inch precipitation zone	1
HA		Hanson extremely stony loam, rolling-----	49	-----	VIIe-1	Silty, 20- to 24-inch precipitation zone	4

## GUIDE TO MAPPING UNITS--Continued

Map symbol		Mapping unit	Page	Capability unit		Range site	Windbreak suitability group
Low intensity	Medium intensity			Irrigated	Dryland		
				Symbol	Symbol	Name	Symbol
HB		Hanson-Babb association, very steep <sup>1/</sup> -----	49	-----	VIIs-1	-----	--
	Hca	Harvey loam, gently undulating-----	50	IIe-1	IIIe-3	Silty, 10- to 14-inch precipitation zone	3L
	Hcb	Harvey loam, undulating-----	50	IIIe-1	IIIe-3	Silty, 10- to 14-inch precipitation zone	3L
	Hcc	Harvey loam, rolling-----	50	-----	IVe-3	Silty, 10- to 14-inch precipitation zone	3L
	Hd	Harvey gravelly loam, undulating---	50	-----	IIIe-3	Silty, 10- to 14-inch precipitation zone	3L
	He	Harvey complex, undulating-----	50	-----	IIIe-3	Silty, 10- to 14-inch precipitation zone	3L
	Hfa	Haverson loam, 0 to 2 percent slopes-----	51	IIc-1	IIIC-1	Silty, 10- to 14-inch precipitation zone	1
	Hfb	Haverson loam, 2 to 4 percent slopes-----	51	IIe-1	IIIe-3	Silty, 10- to 14-inch precipitation zone	1
	Hfc	Haverson loam, saline-----	51	-----	IIIs-2	Saline Lowland, 10- to 14-inch precipitation zone	2S
	Hfd	Haverson silty clay loam-----	51	IIc-2	IIIC-1	Clayey, 10- to 14-inch precipitation zone	1
	Hfe	Haverson silty clay-----	51	IIIs-1	IIIe-3	Clayey, 10- to 14-inch precipitation zone	1
	Hff	Haverson silty clay, thick surface-----	51	IIIs-1	IIIe-3	Clayey, 10- to 14-inch precipitation zone	1
	Hfh	Haverson-Hysham silty clay loams <sup>1/</sup> ---	51	-----	IIIe-3	Clayey, 10- to 14-inch precipitation zone	3S
HGa		Haverson and Glenberg soils-----	52	-----	IIIe-3	Sandy, 10- to 14-inch precipitation zone	2W
HGb		Haverson and Lohmiller soils, channeled-----	52	-----	VIe-1	Silty, 10- to 14-inch precipitation zone	4
HGc		Haverson and Lohmiller soils, frequently flooded-----	52	-----	VIw-1	Overflow, 10- to 14-inch precipitation zone	4
	Hh	Haverson and Lohmiller soils, wet--	52	-----	VIw-1	Saline Lowland, 10- to 14-inch precipitation zone	3W
HK		Haverson soils, saline-----	52	-----	IVs-2	Saline Lowland, 10- to 14-inch precipitation zone	3S
	Hla	Heldt silty clay loam, 0 to 2 percent slopes-----	53	IIIs-1	IIIs-3	Clayey, 10- to 14-inch precipitation zone	1
	Hlb	Heldt silty clay loam, 2 to 4 percent slopes-----	53	IIe-1	IIIe-3	Clayey, 10- to 14-inch precipitation zone	1
	Hlc	Heldt silty clay loam, 4 to 8 percent slopes-----	53	IIIe-1	IIIe-3	Clayey, 10- to 14-inch precipitation zone	1
	Hld	Heldt silty clay loam, 8 to 15 percent slopes-----	53	-----	IVe-3	Clayey, 10- to 14-inch precipitation zone	1
	Hle	Heldt silty clay, 0 to 2 percent slopes-----	53	IIIs-1	-----	Clayey, 10- to 14-inch precipitation zone	1
	Hlf	Heldt-Hysham silty clay loams, 0 to 2 percent slopes-----	53	-----	IIIs-3	Clayey, 10- to 14-inch precipitation zone	3S



## GUIDE TO MAPPING UNITS--Continued

Map symbol	Low inten- sity	Medium inten- sity	Mapping unit	Page	Capability unit		Range site	Windbreak suita- bility group
					Irrigated	Dryland		
					Symbol	Symbol	Name	Symbol
		Hlg	Heldt-Hysham silty clay loams, 2 to 4 percent slopes-----	54	-----	IIIE-3	Clayey, 10- to 14-inch precipitation zone	3S
		Hma	Hesper silty clay loam, 0 to 1 percent slopes-----	54	IIc-2	IIIC-1	Clayey, 10- to 14-inch precipitation zone	1
		Hmb	Hesper silty clay loam, 1 to 4 percent slopes-----	54	IIe-1	IIIE-3	Clayey, 10- to 14-inch precipitation zone	1
		Hmc	Hesper silty clay loam, 4 to 8 percent slopes-----	54	IIIE-1	IIIE-3	Clayey, 10- to 14-inch precipitation zone	1
		Hna	Hydro loam, 0 to 8 percent slopes--	55	-----	IIIC-1	Silty, 10- to 14-inch precipitation zone	2S
		Hnb	Hydro silt loam, 0 to 2 percent slopes-----	55	IIIs-1	IIIC-1	Silty, 10- to 14-inch precipitation zone	2S
		Hnc	Hydro silt loam, 2 to 4 percent slopes-----	55	IIe-1	IIIE-2	Silty, 10- to 14-inch precipitation zone	2S
		Hnd	Hydro silt loam, 4 to 8 percent slopes-----	55	-----	IIIE-2	Silty, 10- to 14-inch precipitation zone	2S
		Hne	Hydro silty clay loam, 0 to 2 percent slopes-----	56	IIIs-1	IIIs-3	Silty, 10- to 14-inch precipitation zone	2S
		Hnf	Hydro silty clay loam, 2 to 4 percent slopes-----	56	IIe-1	IIIE-3	Clayey, 10- to 14-inch precipitation zone	2S
		Hng	Hydro-Allentine complex, 1 to 4 percent slopes-----	56	-----	IVs-2	Pan Spots, 10- to 14-inch precipitation zone	3S
		Hnh	Hydro-Allentine complex, 4 to 8 percent slopes-----	56	-----	IVs-2	Pan Spots, 10- to 14-inch precipitation zone	3S
		Hnk	Hydro-Gilt Edge complex, 0 to 1 percent slopes-----	56	-----	IIIs-3	Clayey, 10- to 14-inch precipitation zone	2S
		Ho	Hysham loam, 0 to 2 percent slopes-	57	-----	VIIs-1	Silty, 10- to 14-inch precipitation zone	3S
		Hp	Hysham silty clay loam, 4 to 8 percent slopes-----	57	-----	VIe-1	Clayey, 10- to 14-inch precipitation zone	3S
		Hr	Hysham silty clay loam, channeled, 0 to 4 percent slopes-----	57	-----	VIIs-1	Clayey, 10- to 14-inch precipitation zone	3S
HS			Hysham-Midway silty clay loams, 4 to 15 percent slopes-----	57	-----	VIe-1	Clayey, 10- to 14-inch precipitation zone	3S
HT			Hysham and Lohmiller silty clay loams, 0 to 8 percent slopes-----	57	-----	VIe-1	Overflow, 10- to 14-inch precipitation zone	3S
		Jc	Judith clay loam, 0 to 2 percent slopes-----	58	IIc-1	IIIs-2	Clayey, 15- to 19-inch precipitation zone	2L
		Jd	Judith clay loam, 2 to 4 percent slopes-----	58	IIe-1	IIe-2	Clayey, 15- to 19-inch precipitation zone	2L

## GUIDE TO MAPPING UNITS--Continued

Map symbol		Mapping unit	Page	Capability unit		Range site	Windbreak suitability group
Low intensity	Medium intensity			Irrigated	Dryland		
				Symbol	Symbol	Name	Symbol
	Je	Judith clay loam, 4 to 8 percent slopes-----	58	IIIE-1	IIIE-2	Clayey, 15- to 19-inch precipitation zone	2L
	Jh	Judith-Windham complex, 4 to 8 percent slopes-----	58	-----	IIIE-2	Clayey, 15- to 19-inch precipitation zone	3L
	Jk	Judith-Windham complex, 8 to 15 percent slopes-----	58	-----	IVe-2	Clayey, 15- to 19-inch precipitation zone	3L
	Kc	Keiser silty clay loam, 0 to 2 percent slopes-----	59	IIc-1	IIIE-1	Clayey, 10- to 14-inch precipitation zone	1
	Kd	Keiser silty clay loam, 2 to 4 percent slopes-----	59	IIe-1	IIIE-3	Clayey, 10- to 14-inch precipitation zone	1
	Ke	Keiser silty clay loam, 4 to 8 percent slopes-----	59	IIIE-1	IIIE-3	Clayey, 10- to 14-inch precipitation zone	1
	Kf	Keiser-Colby complex, gently undulating-----	59	-----	IIIE-3	Clayey, 10- to 14-inch precipitation zone	1
	Kg	Kim loam, 4 to 15 percent slopes---	60	-----	IVe-3	Silty, 10- to 14-inch precipitation zone	1
	Kh	Korchea loam, 0 to 2 percent slopes-----	60	IIc-1	IIc-2	Silty, 15- to 19-inch precipitation zone	1
	Kk	Korchea loam, 2 to 4 percent slopes-----	61	IIe-1	IIe-2	Silty, 15- to 19-inch precipitation zone	1
	Km	Korchea silt loam, 0 to 2 percent slopes-----	61	IIc-1	IIc-2	Silty, 15- to 19-inch precipitation zone	1
	Kn	Korchea silt loam, frequently flooded-----	61	-----	VIw-1	Overflow, 15- to 19-inch precipitation zone	4
	Ko	Korchea silty clay loam, 0 to 2 percent slopes-----	61	IIc-1	IIc-2	Silty, 15- to 19-inch precipitation zone	1
	Kp	Korchea silty clay loam, 2 to 4 percent slopes-----	61	IIe-1	IIe-2	Silty, 15- to 19-inch precipitation zone	1
KR		Korchea and Frazer soils, water table-----	61	-----	IVw-2	Overflow, 15- to 19-inch precipitation zone	2W
	Ks	Kyle silty clay, 0 to 2 percent slopes-----	62	IIIs-1	IIIE-3	Clayey, 10- to 14-inch precipitation zone	1
	Kt	Kyle silty clay, 2 to 4 percent slopes-----	62	IIIE-3	IIIE-3	Clayey, 10- to 14-inch precipitation zone	1
	Ku	Kyle silty clay, 4 to 8 percent slopes-----	62	-----	IIIE-3	Clayey, 10- to 14-inch precipitation zone	1
KV		Kyle gravelly silty clay, 8 to 15 percent slopes-----	62	-----	IVe-3	Clayey, 10- to 14-inch precipitation zone	1
	Kw	Kyle clay, saline-----	62	-----	IVw-2	Saline Lowland, 10- to 14-inch precipitation zone	3S



## GUIDE TO MAPPING UNITS--Continued

Map symbol		Mapping unit	Page	Capability unit		Range site	Windbreak suitability group
Low intensity	Medium intensity			Irrigated	Dryland		
				Symbol	Symbol	Name	Symbol
	La	La Fonda loam, 2 to 4 percent slopes-----	63	-----	IIIe-3	Silty, 10- to 14-inch precipitation zone	2M
LCa		Lap-Trulon complex, rolling-----	63	-----	VIe-1	Silty, 15- to 19-inch precipitation zone	3L
LCb		Lap association, undulating-----	63	-----	VIIs-1	Shallow, 15- to 19-inch precipitation zone	3M
LCc		Lap association, rolling-----	64	-----	VIe-1	Shallow, 15- to 19-inch precipitation zone	3M
LCd		Lap-Armington association, rolling-----	64	-----	VIe-1	Shallow, 15- to 19-inch precipitation zone	4
LD		Lavina-Travessilla loams, undulating-----	64	-----	IVs-2	Shallow, 10- to 14-inch precipitation zone	3M
	Lea	Lennepe loam, 2 to 4 percent slopes-----	65	-----	IIIe-2	Clayey, 15- to 19-inch precipitation zone	2S
	Leb	Lennepe loam, 4 to 8 percent slopes-----	65	-----	IVe-2	Clayey, 15- to 19-inch precipitation zone	2S
	Lec	Lennepe-Adger complex, gently undulating-----	65	-----	IIIe-2	Pan Spots, 15- to 19-inch precipitation zone	3S
	Led	Lennepe-Adger complex, undulating---	66	-----	IVe-2	Pan Spots, 15- to 19-inch precipitation zone	3S
LF		Lismas clay, undulating-----	66	-----	VIe-1	Shallow Clay, 10- to 14-inch precipitation zone	4
LG		Lismas gravelly clay, rolling-----	66	-----	VIe-1	Shallow Clay, 10- to 14-inch precipitation zone	3M
LH		Lismas gravelly clay, hilly-----	66	-----	VIe-1	Shallow Clay, 10- to 14-inch precipitation zone	4
LK		Lismas-Shale outcrop complex, rolling-----	66	-----	VIe-1	Shallow Clay, 10- to 14-inch precipitation zone	3M
LM		Lismas-Shale outcrop complex, steep-----	67	-----	VIIe-1	Shallow Clay, 10- to 14-inch precipitation zone	4
LN		Lismas-Vananda clays, undulating---	67	-----	IVe-3	Shallow Clay, 10- to 14-inch precipitation zone	2S
	Lo	Lohmiller silty clay loam, 0 to 2 percent slopes-----	67	IIIs-1	IIIe-3	Clayey, 10- to 14-inch precipitation zone	1
	Lp	Lohmiller silty clay loam, 2 to 4 percent slopes-----	67	IIe-1	IIIe-3	Clayey, 10- to 14-inch precipitation zone	1
	Lr	Lohmiller silty clay loam, 4 to 8 percent slopes-----	68	IIIe-1	IIIe-3	Clayey, 10- to 14-inch precipitation zone	1
	Ls	Lohmiller silty clay loam, 8 to 15 percent slopes-----	68	-----	IVe-3	Clayey, 10- to 14-inch precipitation zone	1
	Lt	Lohmiller silty clay, saline, 0 to 2 percent slopes-----	68	-----	IVs-2	Saline Lowland, 10- to 14-inch precipitation zone	2S
	Lu	Lohmiller silty clay, saline, 2 to 4 percent slopes-----	68	-----	IVs-2	Saline Lowland, 10- to 14-inch precipitation zone	2S

## GUIDE TO MAPPING UNITS--Continued

Map symbol Low inten- sity	Medium inten- sity	Mapping unit	Page	Capability unit		Range site	Windbreak suita- bility group
				Irrigated	Dryland		
				Symbol	Symbol	Name	Symbol
LV		Lohmiller-Midway silty clay loams, undulating-----	68	-----	IVe-3	Clayey, 10- to 14-inch precipitation zone	2M
	Ma	Macar loam, 4 to 8 percent slopes--	69	IIIe-1	IIIe-3	Silty, 10- to 14-inch precipitation zone	1
MB		Maginnis-Shale outcrop complex, very steep-----	69	-----	VIIe-1	Thin Breaks, 15- to 19-inch precipitation zone	4
MC		Maginnis-Windham complex, hilly----	69	-----	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
	Md	Marias clay, 0 to 2 percent slopes-----	70	IIIs-1	IIs-2	Clayey, 15- to 19-inch precipitation zone	1
	Me	Marias clay, 2 to 4 percent slopes-----	70	IIIe-3	IIE-2	Clayey, 15- to 19-inch precipitation zone	1
	Mf	Marias clay, 4 to 8 percent slopes-----	70	IVe-1	IIIe-3	Clayey, 15- to 19-inch precipitation zone	1
	Mg	Marias clay, 8 to 15 percent slopes-----	70	-----	IVe-2	Clayey, 15- to 19-inch precipitation zone	1
MH		Maschetah complex, rolling-----	71	-----	IVe-2	Silty, 15- to 19-inch precipitation zone	3L
MK		Maschetah-Norbert complex, hilly---	71	-----	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
	Mm	Mayflower silt loam, rolling-----	72	-----	IVe-2	Silty, 20- to 24-inch precipitation zone	2M
MN		Mayflower association, rolling----	72	-----	IVe-2	Silty, 20- to 24-inch precipitation zone	1
	Mo	McKenzie clay-----	73	-----	IIIW-2	Overflow, 10- to 14-inch precipitation zone	1
	Mp	McRae loam, 0 to 1 percent slopes--	73	IIC-1	IIIC-1	Silty, 10- to 14-inch precipitation zone	1
	Mr	McRae loam, 1 to 4 percent slopes--	73	IIE-1	IIIe-3	Silty, 10- to 14-inch precipitation zone	1
	Ms	McRae loam, 4 to 8 percent slopes--	73	IIIe-1	IIIe-3	Silty, 10- to 14-inch precipitation zone	1
	Mt	McRae silty clay loam, 0 to 1 percent slopes-----	73	IIC-1	IIIC-1	Clayey, 10- to 14-inch precipitation zone	1
	Mu	Midway silty clay loam, undulating-----	74	-----	IVe-3	Clayey, 10- to 14-inch precipitation zone	3M
MVa		Midway silty clay loam, rolling----	74	-----	VIe-1	Clayey, 10- to 14-inch precipitation zone	3M
MVb		Midway silty clay loam, hilly-----	74	-----	VIe-1	Thin Hilly, 10- to 14-inch precipitation zone	4
MVc		Midway-Lisnas complex, rolling----	74	-----	VIe-1	Clayey, 10- to 14-inch precipitation zone	3M
MVd		Midway-Lisnas complex, hilly-----	74	-----	VIe-1	Thin Hilly, 10- to 14-inch precipitation zone	4
MVe		Midway-Thedalund complex, rolling--	75	-----	VIe-1	Clayey, 10- to 14-inch precipitation zone	3M
MVf		Midway-Thedalund complex, hilly----	75	-----	VIe-1	Thin Hilly, 10- to 14-inch precipitation zone	4
MVg		Midway-Thurlow association, rolling-----	75	-----	IVe-2	Clayey, 10- to 14-inch precipitation zone	2M



## GUIDE TO MAPPING UNITS--Continued

Map symbol		Mapping unit	Page	Capability unit		Range site	Windbreak suitability group
Low intensity	Medium intensity			Irrigated	Dryland		
				Symbol	Symbol	Name	Symbol
	Mw	Morton silt loam, undulating-----	75	-----	IIIe-2	Silty, 20- to 24-inch precipitation zone	2M
	Nd	Nelson fine sandy loam, undulating-----	76	-----	IVe-3	Sandy, 10- to 14-inch precipitation zone	3M
	Ne	Nelson-Alice fine sandy loams, rolling-----	76	-----	IVe-3	Sandy, 10- to 14-inch precipitation zone	3M
NF		Nelson-Glenberg sandy loams, undulating-----	76	-----	IVe-3	Sandy, 10- to 14-inch precipitation zone	3M
	Ng	Neville loam, rolling-----	77	-----	IIIe-3	Silty, 10- to 14-inch precipitation zone	2M
NH		Norbert-Eltsac clays, hilly-----	78	-----	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
NK		Norbert-Shale outcrop complex, steep-----	78	-----	VIIe-1	Shallow Clay, 15- to 19-inch precipitation zone	4
	Nm	Nunn silty clay loam, 0 to 1 percent slopes-----	79	IIs-1	IIIs-3	Clayey, 10- to 14-inch precipitation zone	1
	Nn	Nunn silty clay loam, 1 to 4 percent slopes-----	79	IIe-1	IIIe-2	Clayey, 10- to 14-inch precipitation zone	1
	No	Nunn silty clay loam, 4 to 8 percent slopes-----	79	IIIe-1	IIIe-2	Clayey, 10- to 14-inch precipitation zone	1
	Nr	Nunn silty clay loam, 8 to 15 percent slopes-----	79	-----	IVe-3	Clayey, 10- to 14-inch precipitation zone	1
NS		Nunn-Midway silty clay loams, 4 to 15 percent slopes-----	79	-----	IVe-3	Clayey, 10- to 14-inch precipitation zone	1
	On	Olney fine sandy loam, 4 to 12 percent slopes-----	80	-----	IIIe-3	Sandy, 10- to 14-inch precipitation zone	2M
	Pa	Parshall fine sandy loam, 4 to 8 percent slopes-----	80	-----	IIIe-2	Sandy, 15- to 19-inch precipitation zone	1
	Pd	Peritsa silt loam, undulating-----	81	-----	IIIe-2	Silty, 15- to 19-inch precipitation zone	2M
PE		Peritsa-Abac loams, rolling-----	81	-----	IVe-2	Silty, 15- to 19-inch precipitation zone	4
PF		Peritsa complex, rolling-----	81	-----	IVe-2	Silty, 15- to 19-inch precipitation zone	1
	Pg	Pierre clay, undulating-----	82	-----	IVe-3	Clayey, 10- to 14-inch precipitation zone	2M
	Ph	Pierre clay, rolling-----	82	-----	VIe-1	Clayey, 10- to 14-inch precipitation zone	2M
	Pk	Pierre-Kyle clays, gently undulating-----	82	-----	IVs-2	Clayey, 10- to 14-inch precipitation zone	2M
PM		Pierre-Lismas clays, rolling-----	82	-----	VIe-1	Clayey, 10- to 14-inch precipitation zone	3M
PN		Pierre-Lismas clays, hilly-----	82	-----	VIe-1	Thin Hilly, 10- to 14-inch precipitation zone	4
PO		Pultney-Neville association, undulating-----	83	-----	IIIe-3	Silty, 10- to 14-inch precipitation zone	3L

## GUIDE TO MAPPING UNITS--Continued

Map symbol		Mapping unit	Page	Capability unit		Range site	Windbreak suitability group
Low intensity	Medium intensity			Irrigated	Dryland		
				Symbol	Symbol	Name	Symbol
QU		Quietus loam <sup>1</sup> /-----	84	-----	VIe-1	-----	--
	Ra	Raynesford loam, undulating-----	84	-----	IVe-2	Silty, 20- to 24-inch precipitation zone	2L
	Rda	Reeder loam, gently undulating----	85	-----	IIe-2	Silty, 15- to 19-inch precipitation zone	2M
	Rdb	Reeder loam, undulating-----	85	-----	IIIe-2	Silty, 15- to 19-inch precipitation zone	2M
	Rdc	Reeder loam, hilly-----	85	-----	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
REa		Reeder-Regent complex, rolling----	85	-----	IVe-2	Silty, 15- to 19-inch precipitation zone	2M
REb		Reeder-Rentsac complex, undulating-----	85	-----	VIIs-1	Silty, 15- to 19-inch precipitation zone	3M
REc		Reeder-Darret association, undulating-----	85	-----	IIIe-2	Silty, 15- to 19-inch precipitation zone	2M
REd		Reeder-Darret association, rolling----	86	-----	IVe-2	Silty, 15- to 19-inch precipitation zone	2M
	Rfa	Regent silty clay loam, gently undulating-----	86	-----	IIe-2	Clayey, 15- to 19-inch precipitation zone	2M
	Rfc	Regent silty clay loam, undulating-----	86	-----	IIIe-2	Clayey, 15- to 19-inch precipitation zone	2M
	Rfd	Regent silty clay loam, rolling----	86	-----	IVe-2	Clayey, 15- to 19-inch precipitation zone	2M
	Re	Renohill silty clay loam, undulating-----	87	-----	IIIe-3	Clayey, 10- to 14-inch precipitation zone	2M
RH		Rentsac-Doney complex, rolling----	87	-----	VIe-1	Shallow, 15- to 19-inch precipitation zone	3M
	Rk	Richfield silty clay loam, 0 to 2 percent slopes-----	88	IIc-2	IIIc-1	Silty, 10- to 14-inch precipitation zone	1
	Rlc	Richfield silty clay loam, gently undulating-----	88	IIe-1	IIIe-3	Silty, 10- to 14-inch precipitation zone	1
	Rld	Richfield silty clay loam, undulating-----	88	IIIe-1	IIIe-3	Silty, 10- to 14-inch precipitation zone	1
	Rle	Richfield-Beauvais silty clay loams, gently undulating-----	88	IIe-1	IIIe-3	Clayey, 10- to 14-inch precipitation zone	1
	Rlf	Richfield-Beauvais silty clay loams, undulating-----	89	IIIe-1	IIIe-3	Clayey, 10- to 14-inch precipitation zone	1
RM		Riverwash-----	89	-----	VIIIs-1	-----	--
---	---	Rock outcrop-----	89	-----	VIIIs-1	-----	--
RN		Rock outcrop-Duncom complex, very steep-----	89	-----	VIIe-1	Shallow, 20- to 24-inch precipitation zone	4
RO		Rock outcrop-Lap complex, very steep-----	89	-----	VIIe-1	Shallow, 15- to 19-inch precipitation zone	4
RP		Rock outcrop-Pultney complex, very steep-----	90	-----	VIIe-1	Shallow, 10- to 14-inch precipitation zone	4



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Map symbol		Mapping unit	Page	Capability unit		Range site	Windbreak suitability group
Low intensity	Medium intensity			Irrigated	Dryland		
				Symbol	Symbol	Name	Symbol
RR		Rock outcrop-Rentsac complex, rolling-----	90	-----	VIe-1	Shallow, 15- to 19-inch precipitation zone	4
RS		Rock outcrop-Windham complex, very steep-----	90	-----	VIIe-1	Thin Breaks, 15- to 19-inch precipitation zone	4
	Rt	Rottulee silt loam, gently undulating-----	91	-----	IIe-2	Silty, 15- to 19-inch precipitation zone	3L
	Ru	Rottulee silt loam, undulating----	91	-----	IIIe-2	Silty, 15- to 19-inch precipitation zone	3L
	Rv	Rottulee silt loam, rolling-----	91	-----	IVe-2	Silty, 15- to 19-inch precipitation zone	3L
RW		Rottulee-Abac complex, rolling-----	91	-----	VIe-1	Silty, 15- to 19-inch precipitation zone	3L
	Ry	Ryorp sandy loam, undulating <sup>1/</sup> -----	91	-----	IVe-2	-----	--
SA		Saline land-----	91	-----	VIw-1	Saline Lowland, 10- to 14-inch precipitation zone	3S
	Sd	Savage silty clay loam, 0 to 2 percent slopes-----	92	IIc-2	IIs-2	Clayey, 15- to 19-inch precipitation zone	1
	Sea	Savage silty clay loam, 2 to 4 percent slopes-----	92	IIe-1	IIe-2	Clayey, 15- to 19-inch precipitation zone	1
	Seb	Savage silty clay loam, 4 to 8 percent slopes-----	92	-----	IIIe-2	Clayey, 15- to 19-inch precipitation zone	1
	Sec	Savage silty clay loam, undulating-----	92	-----	IIIe-2	Clayey, 15- to 19-inch precipitation zone	1
	Sed	Savage silty clay loam, rolling----	93	-----	IVe-2	Clayey, 15- to 19-inch precipitation zone	1
	Sef	Savage-Wayden silty clay loams, 4 to 15 percent slopes-----	93	-----	IVe-2	Clayey, 15- to 19-inch precipitation zone	1
SF		Savage and Frazer soils, 0 to 4 percent slopes-----	93	-----	VIw-1	Clayey, 15- to 19-inch precipitation zone	4
	Sg	Searing loam, undulating-----	94	-----	IIIe-2	Silty, 15- to 19-inch precipitation zone	2M
SH		Searing loam, hilly-----	94	-----	VIe-1	-----	--
SI		Searing-Ringling complex, rolling--	94	-----	IVe-2	Silty, 15- to 19-inch precipitation zone	3M
	Ska	Shaak clay loam, 4 to 8 percent slopes-----	95	IVe-1	IIIe-2	Clayey, 15- to 19-inch precipitation zone	1
	Skb	Shaak silty clay loam, 0 to 2 percent slopes-----	95	IIIs-1	IIs-2	Clayey, 15- to 19-inch precipitation zone	1
	Skc	Shaak silty clay loam, gently undulating-----	95	IIIe-3	IIe-2	Clayey, 15- to 19-inch precipitation zone	1
	Skd	Shaak silty clay loam, undulating--	95	IVe-1	IIIe-2	Clayey, 15- to 19-inch precipitation zone	1
	Ske	Shaak silty clay loam, rolling----	95	-----	IVe-2	Clayey, 15- to 19-inch precipitation zone	1
SM		Shaak complex, 4 to 15 percent slopes-----	96	-----	IVe-2	Clayey, 15- to 19-inch precipitation zone	2M

## GUIDE TO MAPPING UNITS--Continued

Map symbol		Mapping unit	Page	Capability unit		Range site	Windbreak suitability group
Low intensity	Medium intensity			Irrigated	Dryland		
				Symbol	Symbol	Name	Symbol
SOa		Shale outcrop-----	96	-----	VIIIs-1	-----	--
SOc		Shale outcrop-Midway complex, steep-----	96	-----	VIIe-1	Shale, 10- to 14-inch precipitation zone	4
SOd		Shale outcrop-Norbert complex, hilly-----	96	-----	VIIe-1	Shale, 15- to 19-inch precipitation zone	4
	Sp	Shonkin clay loam-----	97	-----	IIIw-2	Overflow, 10- to 14-inch precipitation zone	1
	Sra	Sofia silty clay, 0 to 2 percent slopes-----	97	IIIs-1	IIIs-2	Clayey, 10- to 14-inch precipitation zone	1
	Srb	Sofia silty clay, gently undulating-----	97	IIIe-3	IIe-2	Clayey, 10- to 14-inch precipitation zone	1
SSa		Spearfish-Clapper complex, hilly---	98	-----	VIe-1	Shallow, 10- to 14-inch precipitation zone	4
SSb		Spearfish-Rock outcrop complex, very steep-----	98	-----	VIIe-1	Thin Breaks, 10- to 14-inch precipitation zone	4
SSc		Spearfish-Pultney association, rolling-----	98	-----	VIe-1	Shallow, 10- to 14-inch precipitation zone	4
SSd		Spearfish-Pultney association, hilly-----	98	-----	VIe-1	Thin Hilly, 10- to 14-inch precipitation zone	4
	St	Spearman loam, undulating-----	99	-----	IIIe-3	Silty, 10- to 14-inch precipitation zone	2M
SU		Spearman-Wibaux complex, rolling---	99	-----	IVe-3	Silty, 10- to 14-inch precipitation zone	3M
SVa		Splitro-Sawcreek sandy loams, rolling-----	100	-----	VIe-1	Sandy, 20- to 24-inch precipitation zone	3M
SVb		Splitro-Sawcreek sandy loams, hilly-----	100	-----	VIe-1	Sandy, 20- to 24-inch precipitation zone	4
	Swa	Stormitt extremely stony loam, hilly-----	100	-----	VIIIs-1	Silty, 10- to 14-inch precipitation zone	3L
	Swb	Stormitt complex, 0 to 4 percent slopes-----	101	-----	IVs-2	Shallow to Gravel, 10- to 14-inch precipitation zone	3M
SX		Stormitt complex, 4 to 15 percent slopes-----	101	-----	IVs-2	Silty, 10- to 14-inch precipitation zone	3M
	Taa	Talag clay, 0 to 8 percent slopes--	101	-----	VIIs-1	Clayey, 10- to 14-inch precipitation zone	3S
	Tab	Talag-Allentine complex, 0 to 4 percent slopes-----	102	-----	VIIs-1	Pan Spots, 10- to 14-inch precipitation zone	3S
	Tb	Tarrete silty clay loam, 8 to 15 percent slopes-----	102	-----	IVe-2	Clayey, 15- to 19-inch precipitation zone	2M
TCa		Terrace escarpments, gravelly-----	102	-----	VIIIs-1	Shallow to Gravel, 10- to 14-inch precipitation zone	4
TCb		Terrace escarpments, loamy-----	103	-----	VIe-1	Thin Hilly, 10- to 14-inch precipitation zone	4
	Td	Terry fine sandy loam, undulating--	103	-----	IVe-3	Sandy, 10- to 14-inch precipitation zone	2M



## GUIDE TO MAPPING UNITS--Continued

Map symbol		Mapping unit	Page	Capability unit		Range site	Windbreak suitability group
Low intensity	Medium intensity			Irrigated	Dryland		
				Symbol	Symbol	Name	Symbol
TE		Terry-Travessilla sandy loams, undulating-----	103	-----	VIIs-1	Sandy, 10- to 14-inch precipitation zone	3M
TFa		Teton loam, 8 to 25 percent slopes-----	104	-----	IVe-2	Silty, 20- to 24-inch precipitation zone	2M
TFb		Teton complex, 25 to 45 percent slopes-----	104	-----	VIe-1	Silty, 20- to 24-inch precipitation zone	4
	Tg	Thedalund loam, undulating <sup>1/</sup> -----	105	-----	IIIE-2	Silty, 10- to 14-inch precipitation zone	2M
THa		Thedalund-Clapper complex, hilly---	105	-----	VIe-1	Thin Hilly, 10- to 14-inch precipitation zone	4
THb		Thedalund-Cushman loams, undulating-----	105	-----	IIIE-3	Silty, 10- to 14-inch precipitation zone	2M
THc		Thedalund-Fort Collins complex, rolling-----	105	-----	IVe-3	Silty, 10- to 14-inch precipitation zone	2M
THd		Thedalund-McRae loams, dissected---	105	-----	IVe-3	Silty, 10- to 14-inch precipitation zone	2M
THE		Thedalund-Midway complex, rolling--	105	-----	IVe-3	Silty, 10- to 14-inch precipitation zone	3M
THf		Thedalund-Nelson complex, rolling--	105	-----	IVe-3	Silty, 10- to 14-inch precipitation zone	2M
THg		Thedalund-Rock outcrop complex, hilly-----	105	-----	VIe-1	Thin Hilly, 10- to 14-inch precipitation zone	4
THh		Thedalund-Rock outcrop complex, very steep-----	106	-----	VIIe-1	Thin Breaks, 10- to 14-inch precipitation zone	4
THk		Thedalund-Travessilla loams, rolling-----	106	-----	VIIs-1	Silty, 10- to 14-inch precipitation zone	3M
THl		Thedalund-Wibaux loams, undulating-----	106	-----	VIIs-1	Silty, 10- to 14-inch precipitation zone	3M
THm		Thedalund-Wibaux complex, rolling--	106	-----	VIe-1	Silty, 10- to 14-inch precipitation zone	3M
THn		Thedalund-Wibaux stony loams, hilly-----	106	-----	VIe-1	Thin Hilly, 10- to 14-inch precipitation zone	4
THo		Thedalund-Wibaux complex, very steep-----	106	-----	VIIe-1	Thin Breaks, 10- to 14-inch precipitation zone	4
Tk		Thurlow silty clay loam, 0 to 1 percent slopes-----	107	IIc-2	IIIE-1	Clayey, 10- to 14-inch precipitation zone	1
Tm		Thurlow silty clay loam, 1 to 4 percent slopes-----	107	IIe-1	IIIE-3	Clayey, 10- to 14-inch precipitation zone	1
Tn		Thurlow silty clay loam, 4 to 8 percent slopes-----	107	IIIE-1	IIIE-3	Clayey, 10- to 14-inch precipitation zone	1
To		Thurlow-Midway silty clay loams, 4 to 15 percent slopes-----	107	-----	IVe-3	Clayey, 10- to 14-inch precipitation zone	1
Tp		Toluca-Harvey complex, undulating--	108	-----	IIIE-3	Clayey, 10- to 14-inch precipitation zone	2L

## GUIDE TO MAPPING UNITS--Continued

Map symbol	Low intensity	Medium intensity	Mapping unit	Page	Capability unit		Range site	Windbreak suitability group
					Irrigated	Dryland		
					Symbol	Symbol	Name	Symbol
TR			Travessilla-Rock outcrop complex, rolling-----	109	-----	VIIs-1	Shallow, 10- to 14-inch precipitation zone	4
TS			Travessilla-Thedalund loams, rolling-----	109	-----	VIe-1	Silty, 10- to 14-inch precipitation zone	3M
		Tu	Tullock loamy fine sand, rolling---	110	-----	VIe-1	Sands, 10- to 14-inch precipitation zone	3M
		Tv	Twin Creek loam, 2 to 4 percent slopes-----	110	IIe-1	IIe-2	Silty, 15- to 19-inch precipitation zone	1
		Tw	Twin Creek loam, 4 to 8 percent slopes-----	111	-----	IIIe-2	Silty, 15- to 19-inch precipitation zone	1
		Tx	Twin Creek loam, 8 to 15 percent slopes-----	111	-----	IVe-2	Silty, 15- to 19-inch precipitation zone	1
TY			Twin Creek-Korchea complex, 2 to 8 percent slopes-----	111	-----	IIe-2	Silty, 15- to 19-inch precipitation zone	1
		Va	Vananda clay, 0 to 1 percent slopes-----	111	IVs-1	VIIs-1	Dense Clay, 10- to 14-inch precipitation zone	3S
		Vc	Vananda clay, 1 to 8 percent slopes-----	111	-----	VIe-1	Dense Clay, 10- to 14-inch precipitation zone	3S
		Vd	Vebar fine sandy loam, undulating--	112	-----	IIIe-2	Sandy, 15- to 19-inch precipitation zone	2M
		Ve	Vebar fine sandy loam, rolling----	112	-----	IVe-2	Sandy, 15- to 19-inch precipitation zone	2M
VF			Vebar-Castner complex, undulating--	112	-----	VIIs-1	Sandy, 15- to 19-inch precipitation zone	3M
VH			Vebar-Castner complex, rolling----	112	-----	VIIs-1	Sandy, 15- to 19-inch precipitation zone	3M
VM			Vebar complex, rolling-----	112	-----	IVe-2	Sandy, 15- to 19-inch precipitation zone	2M
		Wa	Wages loam, 0 to 2 percent slopes--	113	IIc-1	IIIC-1	Silty, 10- to 14-inch precipitation zone	1
		Wb	Wages loam, 2 to 4 percent slopes--	113	IIe-1	IIIe-3	Silty, 10- to 14-inch precipitation zone	1
		Wc	Wages loam, 4 to 8 percent slopes--	113	IIIe-1	IIIe-3	Silty, 10- to 14-inch precipitation zone	1
WD			Wayden silty clay loam, rolling----	114	-----	VIe-1	Clayey, 15- to 19-inch precipitation zone	3M
WE			Wayden silty clay loam, hilly-----	114	-----	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
WF			Wayden-Arnegard complex, hilly----	114	-----	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
WG			Wayden-Grail complex, hilly-----	114	-----	VIe-1	Clayey, 15- to 19-inch precipitation zone	4
WH			Wayden-Judith silty clay loams, hilly-----	115	-----	VIe-1	Clayey, 15- to 19-inch precipitation zone	4
WI			Wayden-Regent silty clay loams, hilly-----	115	-----	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
WK			Wayden-Savage silty clay loams, rolling-----	115	-----	IVe-2	Clayey, 15- to 19-inch precipitation zone	2M



## GUIDE TO MAPPING UNITS--Continued

Map symbol		Mapping unit	Page	Capability unit		Range site	Windbreak suitability group
Low intensity	Medium intensity			Irrigated	Dryland		
Symbol	Symbol			Symbol	Symbol	Name	Symbol
WL		Wayden-Rock outcrop complex, rolling-----	115	-----	VIe-1	Clayey, 15- to 19-inch precipitation zone	3M
WM		Wayden-Rock outcrop complex, hilly-	115	-----	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
WN		Wayden-Shale outcrop complex, very steep-----	115	-----	VIIe-1	Shale, 15- to 19-inch precipitation zone	4
WO		Wayden complex, hilly-----	115	-----	VIIe-1	Thin Breaks, 15- to 19-inch precipitation zone	4
	Wp	Wibaux loam, hilly-----	116	-----	VIe-1	Shallow, 10- to 14-inch precipitation zone	3M
	Wr	Wibaux-Spearman complex, rolling---	116	-----	VIe-1	Shallow, 10- to 14-inch precipitation zone	3M
	Ws	Windham cobbly loam, 15 to 35 percent slopes-----	117	-----	VIe-1	Shallow to Gravel, 15- to 19-inch precipitation zone	4
WT		Windham complex, 15 to 35 percent slopes-----	117	-----	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
WU		Windham-Arnegard complex, 15 to 35 percent slopes-----	117	-----	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
WV		Windham-Norbert complex, 15 to 50 percent slopes-----	117	-----	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
WW		Windham-Wayden complex, 15 to 35 percent slopes-----	117	-----	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
WX		Windham-Lap association, very steep-----	117	-----	VIIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
	Wy	Winnett complex, undulating-----	118	-----	VIe-1	Pan Spots, 10- to 14-inch precipitation zone	3S
	Xa	Xavier silty clay loam, gently undulating-----	119	IIe-1	IIe-2	Silty, 15- to 19-inch precipitation zone	1
	Xc	Xavier silty clay loam, undulating-	119	IIIE-1	IIIE-2	Silty, 15- to 19-inch precipitation zone	1
	Xe	Xavier silty clay loam, rolling----	119	-----	IVe-2	Silty, 15- to 19-inch precipitation zone	1
	Xh	Xavier-Shaak complex, undulating---	119	-----	IIIE-2	Clayey, 15- to 19-inch precipitation zone	1
	Xk	Xavier-Shaak complex, rolling-----	119	-----	IVe-2	Clayey, 15- to 19-inch precipitation zone	1

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# Accessibility Statement

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## SOIL ASSOCIATIONS

### SOILS DOMINANTLY ON STREAM TERRACES AND ALLUVIAL FANS

- 1 Kyle-Lohmiller-Haverson association: Deep, nearly level to steep, well-drained soils on flood plains, terraces, fans, and foot slopes
- 2 Korchea-Farnuf-Savage association: Deep, nearly level to steep, well-drained soils on fans, foot slopes, flood plains, and terraces

### SOILS DOMINANTLY ON HIGH GRAVEL TERRACES, FANS, AND BENCHES

- 3 Judith-Danvers-Windham association: Deep, nearly level to very steep and gently undulating to hilly, well-drained soils on fans, terraces, and benches
- 4 Keiser-Hydro-Gilt Edge association: Deep, nearly level to gently sloping and gently undulating, well-drained soils on terraces, fans, and benches

- 5 Spearfish-Pultney-Stormitt association: Shallow to deep, nearly level to very steep, well-drained soils on fans, benches, and sedimentary uplands

- 6 Wayden-Xavier-Belfield association: Shallow to deep, nearly level to very steep and gently undulating to hilly, well-drained soils on fans, terraces, foot slopes, benches, and sedimentary uplands

- 7 Beauvais association: Deep, gently undulating to hilly, well-drained soils on terraces, fans, foot slopes, and loess-covered hills

### SOILS ON SANDSTONE HILLS

- 8 Nelson-Alice association: Moderately deep and deep, gently sloping to strongly sloping and undulating to rolling, well-drained soils on foot slopes, fans, valley bottoms, and sedimentary uplands

- 9 Dast-Verbar-Parshall association: Moderately deep and deep, undulating to hilly and strongly sloping to very steep, well-drained soils on foot slopes, fans, valley bottoms, and sedimentary uplands

### SOILS ON DISSECTED SHALE HILLS

- 10 Pierre-Lismas-Kyle association: Shallow to deep, nearly level to very steep and gently undulating to hilly, well-drained soils on fans, foot slopes, terraces, and sedimentary uplands

- 11 Thedalund-Midway association: Moderately deep and shallow, undulating to hilly and gently sloping to very steep, well-drained soils on sedimentary uplands

- 12 Wibaux-Thedalund-Spearman association: Shallow and moderately deep, undulating to very steep, well-drained to excessively drained soils on sedimentary uplands

- 13 Ringling-Searing-Arnegard association: Shallow to deep, gently sloping to very steep and undulating to hilly, well-drained soils on fans, foot slopes, and sedimentary uplands

- 14 Doney-Reeder-Wayden association: Moderately deep and shallow, gently undulating to very steep, well-drained soils on sedimentary uplands

- 15 Midway-Nunn association: Shallow to deep, nearly level to steep and undulating to hilly, well-drained soils on terraces, fans, foot slopes, and sedimentary uplands

- 16 Wayden-Regent-Shale outcrop association: Shallow and moderately deep, gently undulating to hilly and strongly sloping to very steep, well-drained soils and Shale outcrop on sedimentary uplands

- 17 Midway association: Shallow and moderately deep, undulating to hilly and gently sloping to very steep, well-drained soils on sedimentary uplands

### SOILS ON INTERMIXED DISSECTED SHALE AND SANDSTONE HILLS

- 18 Abac-Peritsa association: Shallow and moderately deep, undulating to rolling and very steep, well-drained soils on sedimentary uplands

- 19 Absarokee-Maginnis association: Moderately deep and shallow, gently undulating to hilly and gently sloping to very steep, well-drained soils on sedimentary uplands

- 20 Absarokee association: Moderately deep, gently undulating to hilly and gently sloping to steep, well-drained soils on sedimentary uplands

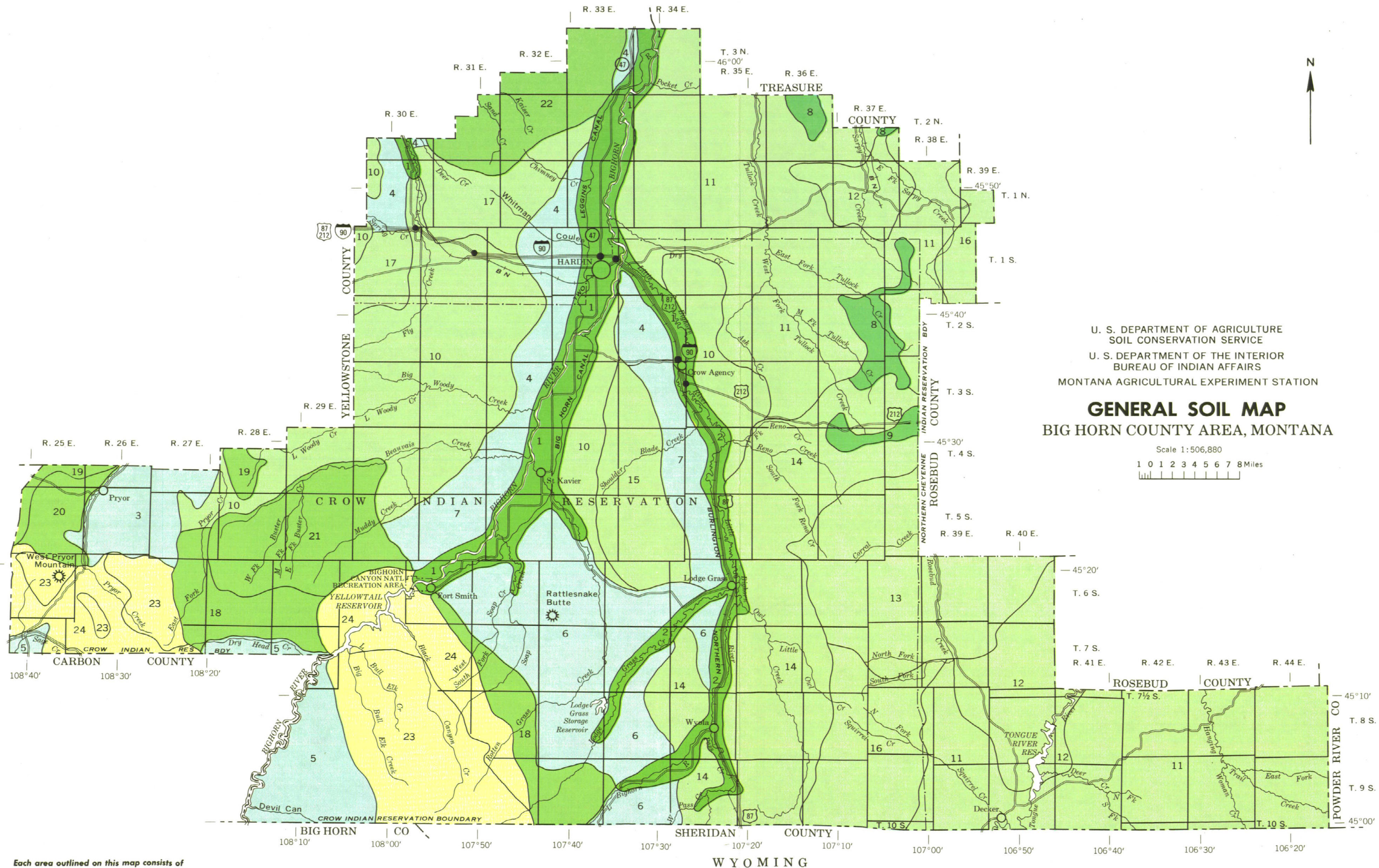
- 21 Wayden-Castner association: Shallow, undulating to hilly and strongly sloping to very steep, well-drained soils on sedimentary uplands

- 22 Thedalund-Travessilla association: Moderately deep and shallow, undulating to rolling and very steep, well-drained soils on sedimentary uplands

### SOILS ON MOUNTAINS

- 23 Duncom-Tarrete-Mayflower association: Shallow and moderately deep, rolling to hilly and strongly sloping to very steep, well-drained soils on sedimentary highlands

- 24 Lap-Armington-Reeder association: Shallow to deep, undulating to hilly and strongly sloping to very steep, well-drained soils on sedimentary highlands



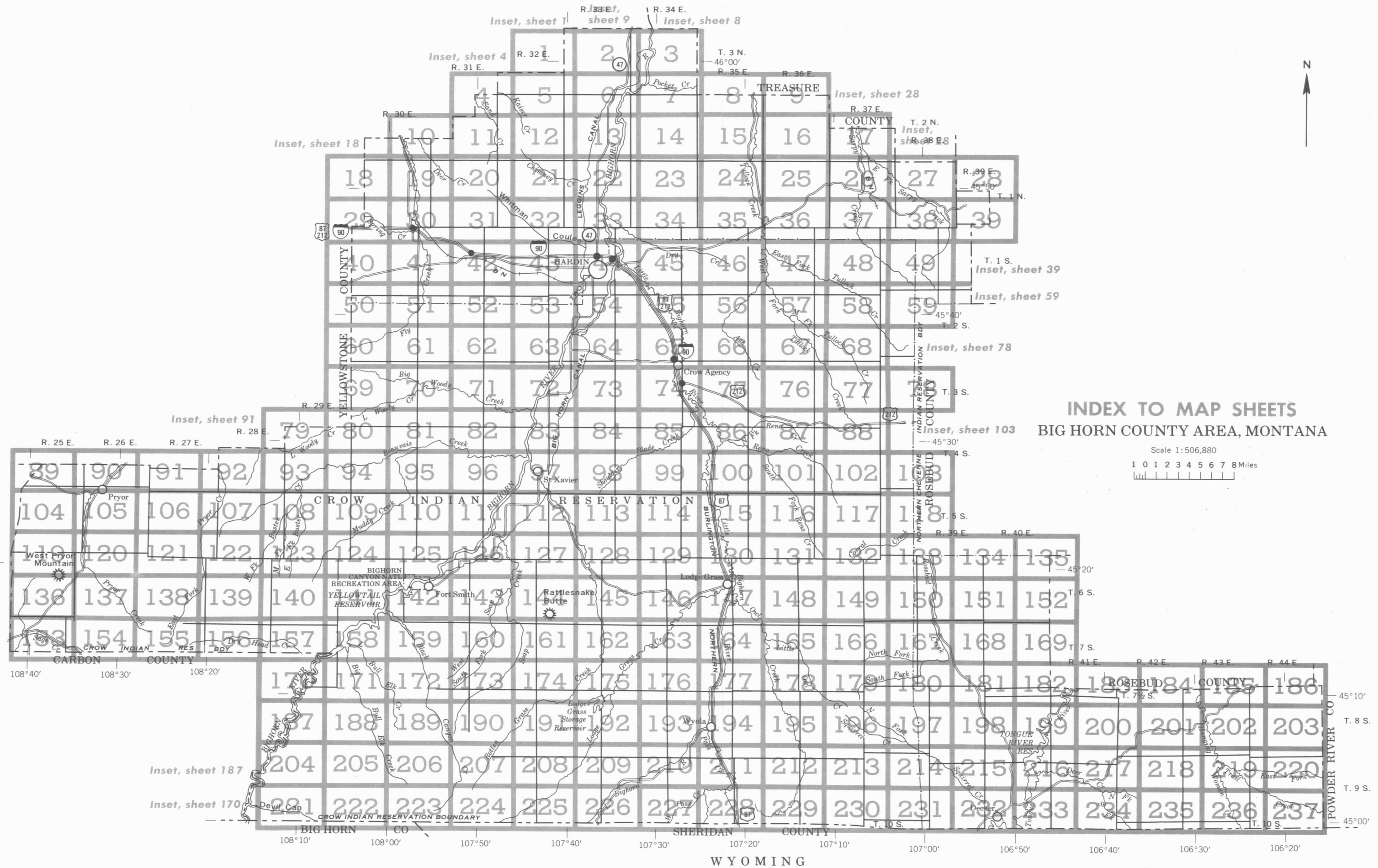
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SOIL CONSERVATION SERVICE  
U. S. DEPARTMENT OF THE INTERIOR  
BUREAU OF INDIAN AFFAIRS  
MONTANA AGRICULTURAL EXPERIMENT STATION

## GENERAL SOIL MAP BIG HORN COUNTY AREA, MONTANA

Scale 1:506,880  
1 0 1 2 3 4 5 6 7 8 Miles

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.







SOIL LEGEND

The first letter, always a capital, is the initial one of the soil name. The second letter is a capital if the mapping unit is one of the low intensity survey; it is a small letter if the mapping unit is one of the medium intensity survey.

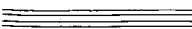

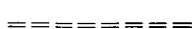

SYMBOL		NAME	SYMBOL		NAME	SYMBOL		NAME	SYMBOL		NAME	SYMBOL		NAME	SYMBOL		NAME
Low Intensity	Medium Intensity		Low Intensity	Medium Intensity		Low Intensity	Medium Intensity		Low Intensity	Medium Intensity		Low Intensity	Medium Intensity		Low Intensity	Medium Intensity	
-	Aa	Abac loam, rolling	CU	-	Colby-Clapper silt loams, rolling	-	Hcb	Harvey loam, undulating	-	Lea	Lenneq loam, 2 to 4 percent slopes	QU	-	Quietus loam	TCa	-	Terrace escarpments, gravelly
AB	-	Abac loam, hilly	-	Cv	Colby-Keiser silty clay loams, 4 to 8 percent slopes	-	Hcc	Harvey loam, rolling	-	Leb	Lenneq loam, 4 to 8 percent slopes	-	Ra	Raynesford loam, undulating	TCb	-	Terrace escarpments, loamy
AC	-	Abac-Bitton complex, hilly	CW	-	Colby-Midway complex, 8 to 15 percent slopes	-	Hd	Harvey gravelly loam, undulating	-	Lec	Lenneq-Adger complex, gently undulating	-	Rdb	Reeder loam, gently undulating	-	Td	Terry fine sandy loam, undulating
AD	-	Abac-Rock outcrop complex, very steep	CX	-	Colby association, rolling	-	He	Harvey complex, undulating	-	Led	Lenneq-Adger complex, undulating	-	Rda	Reeder loam, undulating	TE	-	Terry-Travessilla sandy loams, undulating
-	Ae	Absarokee silty clay loam, gently undulating	CY	-	Colby association, hilly	-	Hfa	Haverson loam, 0 to 2 percent slopes	LF	-	Lismaa clay, undulating	-	Rdb	Reeder loam, hilly	TFa	-	Teton loam, 8 to 25 percent slopes
-	Af	Absarokee silty clay loam, undulating	-	Cz	Cushman loam, undulating	-	Hfb	Haverson loam, 2 to 4 percent slopes	LG	-	Lismaa gravelly clay, rolling	-	Rdc	Reeder loam, rolling	TFb	-	Teton complex, 25 to 45 percent slopes
-	Ag	Absarokee silty clay loam, rolling	-	-	-	-	Hfc	Haverson loam, saline	LH	-	Lismaa gravelly clay, hilly	-	Re	Renohill silty clay loam, undulating	-	Tg	Thedalund loam, undulating
AH	-	Absarokee silty clay loam, hilly	-	Da	Danvers silty clay loam, 0 to 1 percent slopes	-	Hfd	Haverson silty clay loam	LK	-	Lismaa-Shale outcrop complex, rolling	REa	-	Reeder-Regent complex, rolling	THa	-	Thedalund-Clapper complex, hilly
-	Ak	Absarokee-Castner complex, undulating	-	Db	Danvers silty clay loam, gently undulating	-	Hfe	Haverson silty clay	LM	-	Lismaa-Shale outcrop complex, steep	REb	-	Reeder-Rentsac complex, undulating	THb	-	Thedalund-Cushman loams, undulating
AL	-	Absarokee-Castner complex, hilly	-	Dc	Danvers silty clay loam, undulating	-	Hff	Haverson silty clay, thick surface	LN	-	Lismaa-Vananda clays, undulating	REc	-	Reeder-Darret association, undulating	THc	-	Thedalund-Fort Collins complex, rolling
AM	-	Absarokee-Armington association, gently sloping	-	Dd	Danvers cobbly silty clay loam, 1 to 4 percent slopes	-	Hfh	Haverson-Hyham silty clay loam	-	Lo	Lohmiller silty clay loam, 0 to 2 percent slopes	REd	-	Reeder-Darret association, rolling	THd	-	Thedalund-McRae loams, dissected
-	An	Absher-Nobe clays	-	De	Danvers-Judith silty clay loams, gently undulating	HGa	-	Haverson and Glenberg soils	-	Lp	Lohmiller silty clay loam, 2 to 4 percent slopes	-	Rfa	Regent silty clay loam, gently undulating	THe	-	Thedalund-Midway complex, rolling
AO	-	Adel-Mayflower association, sloping	-	Df	Danvers-Judith silty clay loams, undulating	HGb	-	Haverson and Lohmiller soils, channeled	-	Lr	Lohmiller silty clay loam, 4 to 8 percent slopes	-	Rfc	Regent silty clay loam, undulating	THf	-	Thedalund-Nelson complex, rolling
-	Ap	Adger clay, 0 to 8 percent slopes	-	Dg	Danvers-Judith silty clay loams, hilly	HGc	-	Haverson and Lohmiller soils, frequently flooded	-	Ls	Lohmiller silty clay loam, 8 to 15 percent slopes	-	Rfd	Regent silty clay loam, rolling	THg	-	Thedalund-Rock outcrop complex, hilly
-	Ar	Alice fine sandy loam, 4 to 15 percent slopes	DHa	-	Dast sandy loam, rolling	-	Hh	Haverson and Lohmiller soils, wet	-	Lt	Lohmiller silty clay, saline, 0 to 2 percent slopes	RH	-	Rentsac-Doney complex, rolling	THh	-	Thedalund-Rock outcrop complex, very steep
-	Asa	Allentine clay, 0 to 2 percent slopes	DHb	-	Dast sandy loam, hilly	HK	-	Haverson soils, saline	-	Lu	Lohmiller silty clay, saline, 2 to 4 percent slopes	-	Rk	Richfield silty clay loam, 0 to 2 percent slopes	THk	-	Thedalund-Travessilla loams, rolling
-	Asb	Allentine clay, 2 to 4 percent slopes	DHc	-	Dast complex, hilly	-	Hia	Heldt silty clay loam, 0 to 2 percent slopes	LV	-	Lohmiller-Midway silty clay loams, undulating	-	Ric	Richfield silty clay loam, gently undulating	THl	-	Thedalund-Wibaux loams, undulating
-	Asc	Allentine-Bone complex, 0 to 1 percent slopes	DHd	-	Dast complex, very steep	-	Hib	Heldt silty clay loam, 2 to 4 percent slopes	-	Ma	Macar loam, 4 to 8 percent slopes	-	Rid	Richfield silty clay loam, undulating	THm	-	Thedalund-Wibaux complex, rolling
-	Asd	Allentine-Bone complex, 1 to 4 percent slopes	-	Dk	Dast-Parshall sandy loams, rolling	-	Hic	Heldt silty clay loam, 4 to 8 percent slopes	-	MB	Maginnis-Shale outcrop complex, very steep	-	Rie	Richfield-Bauvais silty clay loams, gently undulating	THn	-	Thedalund-Wibaux stony loams, hilly
ATa	-	Alluvial land, gravelly	Dma	-	Doney loam, rolling	-	Hid	Heldt silty clay loam, 8 to 15 percent slopes	-	MC	Maginnis-Windham complex, hilly	RM	-	Richfield-Bauvais silty clay loams, undulating	THo	-	Thedalund-Wibaux complex, very steep
ATb	-	Alluvial land, cobbly	Dmb	-	Doney silty clay loam, hilly	-	Hie	Heldt silty clay loam, 0 to 2 percent slopes	-	-	-	-	Rif	Richfield-Bauvais silty clay loams, undulating	-	Tk	Thurloa silty clay loam, 0 to 1 percent slopes
ATc	-	Alluvial land, wet	-	Dn	Doney-Reeder loams, rolling	-	Hif	Heldt-Hyham silty clay loams, 0 to 2 percent slopes	-	-	-	RO	-	Richfield-Bauvais silty clay loams, undulating	-	Tm	Thurloa silty clay loam, 1 to 4 percent slopes
-	Au	Amherst loam, undulating	DOa	-	Doney-Ringling complex, rolling	-	Hig	Heldt-Hyham silty clay loams, 2 to 4 percent slopes	-	-	-	RP	-	Richfield-Bauvais silty clay loams, undulating	-	Tn	Thurloa silty clay loam, 4 to 8 percent slopes
AVa	-	Amherst loam, rolling	DOb	-	Doney-Ringling complex, hilly	-	Hma	Hesper silty clay loam, 0 to 1 percent slopes	-	-	-	RR	-	Richfield-Bauvais silty clay loams, undulating	-	To	Thurloa-Midway silty clay loams, 4 to 15 percent slopes
AVb	-	Amherst complex, rolling	DOc	-	Doney-Ringling complex, very steep	-	Hmb	Hesper silty clay loam, 1 to 4 percent slopes	-	-	-	RS	-	Richfield-Bauvais silty clay loams, undulating	TR	-	Toluca-Harvey complex, undulating
AVc	-	Amherst complex, hilly	DOd	-	Doney-Rock outcrop complex, very steep	-	Hmc	Hesper silty clay loam, 4 to 8 percent slopes	MH	-	Maschetah complex, rolling	-	Rt	Rock outcrop-Windham complex, very steep	-	Tp	Travessilla-Rock outcrop complex, rolling
AVd	-	Amherst-Maginnis complex, hilly	DOe	-	Doney-Wayden complex, hilly	-	Hna	Hydro loam, 0 to 8 percent slopes	MK	-	Maschetah-Norbert complex, hilly	-	Ru	Rock outcrop-Lap complex, very steep	TS	-	Travessilla-Thedalund loams, rolling
AWa	-	Armington silty clay loam	-	Dp	Duncom extremely channery loam, rolling	-	Hnb	Hydro silt loam, 0 to 2 percent slopes	-	Mm	Mayflower silt loam, rolling	-	Rv	Rock outcrop-Pultney complex, very steep	-	Tu	Tullock loamy fine sand, rolling
AWb	-	Armington complex, rolling	DR	-	Duncom complex, rolling	-	Hnc	Hydro silt loam, 2 to 4 percent slopes	-	MN	Mayflower association, rolling	-	Rw	Rock outcrop-Pultney complex, very steep	-	Tv	Twin Creek loam, 2 to 4 percent slopes
-	Axa	Arnegard loam, 8 to 15 percent slopes	DS	-	Duncom-Tarrete association, rolling	-	Hnd	Hydro silt loam, 4 to 8 percent slopes	-	-	-	SA	-	Rock outcrop-Pultney complex, very steep	-	Tw	Twin Creek loam, 4 to 8 percent slopes
-	Axb	Arnegard silt loam, 2 to 4 percent slopes	DT	-	Duncom-Tarrete association, hilly	-	Hne	Hydro silty clay loam, 0 to 2 percent slopes	-	Mo	McKenzie clay	-	Ry	Rock outcrop-Pultney complex, very steep	-	Tx	Twin Creek loam, 8 to 15 percent slopes
-	Axc	Arnegard silt loam, 4 to 8 percent slopes	-	Ec	Eltsac clay, undulating	-	Hnf	Hydro silty clay loam, 2 to 4 percent slopes	-	Mr	McRae loam, 1 to 4 percent slopes	-	-	Rock outcrop-Pultney complex, very steep	TY	-	Twin Creek-Korchea complex, 2 to 8 percent slopes
-	Ayd	Arvada silty clay loam	-	Ed	Eltsac clay, rolling	-	Hng	Hydro-Allentine complex, 1 to 4 percent slopes	-	Ms	McRae loam, 4 to 8 percent slopes	-	-	Rock outcrop-Pultney complex, very steep	-	Va	Vananda clay, 0 to 1 percent slopes
-	Aye	Arvada-Bone clays	-	EH	Eltsac cobbly clay, hilly	-	Hnh	Hydro-Allentine complex, 4 to 8 percent slopes	-	Mt	McRae silty clay loam, 0 to 1 percent slopes	-	Sa	Saline land	-	Vb	Vananda clay, 1 to 8 percent slopes
-	Az	Ascalon sandy loam, 4 to 8 percent slopes	-	-	-	-	Hnk	Hydro-Gilt Edge complex, 0 to 1 percent slopes	-	Mu	Midway silty clay loam, undulating	-	Sea	Savage silty clay loam, 0 to 2 percent slopes	-	Vc	Vananda clay, 1 to 8 percent slopes
BA	-	Babb silt loam, rolling	-	Fa	Farnuf loam, 0 to 2 percent slopes	-	Hn	Hysham loam, 0 to 2 percent slopes	MVa	-	Midway silty clay loam, rolling	-	Seb	Savage silty clay loam, 2 to 4 percent slopes	-	Vd	Vebar fine sandy loam, undulating
BB	-	Babb silt loam, hilly	-	Fb	Farnuf loam, 2 to 4 percent slopes	-	Hp	Hysham silty clay loam, 4 to 8 percent slopes	MVb	-	Midway silty clay loam, hilly	-	Sec	Savage silty clay loam, 4 to 8 percent slopes	-	Ve	Vebar fine sandy loam, rolling
-	Bc	Beauvais silty clay loam, gently undulating	-	Fc	Farnuf loam, 4 to 8 percent slopes	HS	-	Hysham silty clay loam, channeled, 0 to 4 percent slopes	MVc	-	Midway-Lismaa complex, rolling	-	Sed	Savage silty clay loam, rolling	VF	-	Vebar-Castner complex, undulating
-	Bd	Beauvais silty clay loam, undulating	-	Fd	Farnuf-Doney association, sloping	HT	-	Hysham-Midway silty clay loams, 4 to 15 percent slopes	MVd	-	Midway-Lismaa complex, hilly	-	Sef	Savage silty clay loam, rolling	VH	-	Vebar-Castner complex, rolling
-	Be	Beauvais silty clay loam, rolling	-	Fe	Fergus silty loam, 2 to 4 percent slopes	-	-	Hysham and Lohmiller silty clay loams, 0 to 8 percent slopes	MVe	-	Midway-Thedalund complex, rolling	SF	-	Savage silty clay loam, rolling	VM	-	Vebar complex, rolling
-	Bf	Beauvais-Gilt Edge silty clay loams, gentle undulating	-	Ff	Fergus silty loam, 4 to 8 percent slopes	-	Jc	Judith clay loam, 0 to 2 percent slopes	MVf	-	Midway-Thedalund complex, hilly	-	Sg	Savage and Frazer soils, 0 to 4 percent slopes	-	Wa	Wages loam, 0 to 2 percent slopes
-	Bg	Beffield silt loam, 0 to 1 percent slopes	-	Fg	Fergus silty loam, 8 to 15 percent slopes	-	Jd	Judith clay loam, 2 to 4 percent slopes	MVg	-	Midway-Thurloa association, rolling	SH	-	Searing loam, undulating	-	Wb	Wages loam, 2 to 4 percent slopes
-	Bh	Beffield silt loam, gently undulating	-	Fh	Fort Collins loam, 0 to 2 percent slopes	-	Je	Judith clay loam, 4 to 8 percent slopes	-	Mw	Morton silt loam, undulating	SI	-	Searing loam, hilly	-	Wc	Wages loam, 4 to 8 percent slopes
-	Bi	Beffield silt loam, undulating	-	Fi	Fort Collins loam, 2 to 4 percent slopes	-	Jf	Judith-Windham complex, 4 to 8 percent slopes	-	-	-	-	Ska	Shaak clay loam, 4 to 8 percent slopes	-	Wd	Wayden silty clay loam, rolling
-	Bk	Beffield silt loam, undulating	-	Fk	Fort Collins loam, 4 to 8 percent slopes	-	Jg	Judith-Windham complex, 8 to 15 percent slopes	-	Nd	Nelson fine sandy loam, undulating	-	Skb	Shaak silty clay loam, 0 to 2 percent slopes	WD	-	Wayden silty clay loam, rolling
-	Bm	Beffield-Adger complex, 0 to 1 percent slopes	-	Fm	Fort Collins loam, 8 to 15 percent slopes	-	Jh	Judith-Windham complex, 8 to 15 percent slopes	-	Ne	Nelson-Alice fine sandy loams, rolling	-	Skc	Shaak silty clay loam, gently undulating	WE	-	Wayden silty clay loam, hilly
-	Bn	Beffield-Adger complex, gently undulating	-	Fn	Fort Collins loam, 2 to 4 percent slopes	-	Ji	Judith-Windham complex, 8 to 15 percent slopes	-	Nf	Nelson-Glenberg sandy loams, undulating	-	Skd	Shaak silty clay loam, undulating	WF	-	Wayden-Arnegard complex, hilly
-	Bo	Beffield-Adger complex, undulating	-	Fo	Fort Collins loam, channeled, 4 to 8 percent slopes	-	Jk	Judith-Windham complex, 8 to 15 percent slopes	-	Ng	Neville loam, rolling	-	Ske	Shaak silty clay loam, rolling	WG	-	Wayden-Graill complex, hilly
-	Bp	Benteen loam, rolling	-	Fp	Frazer silty clay loam	-	-	-	-	Nh	Norbert-Eltsac clays, hilly	SM	-	Shaak complex, 4 to 15 percent slopes	WH	-	Wayden-Judith silty clay loams, hilly
-	Br	Benteen loam, hilly	-	Fs	Frazer silty clay loam, saline	-	-	-	-	Ni	Norbert-Shale outcrop complex, steep	SOa	-	Shaak complex, 4 to 15 percent slopes	WI	-	Wayden-Regent silty clay loams, hilly
-	Bs	Bew silty clay loam, 0 to 1 percent slopes	FT	-	Frazer and Korchea soils, channeled	-	Kc	Keiser silty clay loam, 0 to 2 percent slopes	-	Nk	Norbert-Shale outcrop complex, rolling	-	Soc	Shaak complex, 4 to 15 percent slopes	WK	-	Wayden-Savage silty clay loams, rolling
-	Bt	Bew silty clay loam, gently undulating	-	-	-	-	Kd	Keiser silty clay loam, 2 to 4 percent slopes	-	Nm	Nunn silty clay loam, 0 to 1 percent slopes	-	Sod	Shaak complex, 4 to 15 percent slopes	WL	-	Wayden-Rock outcrop complex, rolling
BU	-	Bitton gravelly loam, 2 to 8 percent slopes	-	Gc	Gilt Edge silty clay loam, 0 to 2 percent slopes	-	Ke	Keiser silty clay loam, 4 to 8 percent slopes	-	Nn	Nunn silty clay loam, 1 to 4 percent slopes	-	Sp	Shonkin clay loam	WM	-	Wayden-Rock outcrop complex, rolling
BV	-	Bitton silty clay loam, 2 to 8 percent slopes	-	Gd	Gilt Edge silty clay loam, 2 to 4 percent slopes	-	Kf	Keiser silty clay loam, 8 to 15 percent slopes	-	No	Nunn silty clay loam, 4 to 8 percent slopes	-	Sr	Sofia silty clay, 0 to 2 percent slopes	WN	-	Wayden-Rock outcrop complex, rolling
-	Bw	Bitton silty clay loam, 4 to 8 percent slopes	-	Ge	Gilt Edge-Bone complex, 0 to 1 percent slopes	-	Kg	Keiser silty clay loam, 8 to 15 percent slopes	-	Nr	Nunn silty clay loam, 8 to 15 percent slopes	NS	-	Sofia silty clay, gently undulating	WO	-	Wayden-Rock outcrop complex, very steep
-	-	Bone clay	-	Gf	Gilt Edge-Bone complex, 1 to 4 percent slopes	-	Kh	Keiser-Colby complex, gently undulating	-	-	-	-	Srb	Sofia silty clay, gently undulating	-	Wp	Wayden complex, hilly
CA	-	Castner-Reeder loams, undulating	-	Gg	Gilt Edge-Bone complex, 1 to 4 percent slopes	-	Ki	Keiser-Colby complex, gently undulating	-	On	Olney fine sandy loam, 4 to 12 percent slopes	-	SSa	Spearfish-Clapper complex, hilly	-	Wq	Wayden complex, hilly
CB	-	Castner-Reeder loams, rolling	-	Gh	Glenberg fine sandy loam, 0 to 2 percent slopes	-	Kj	Keiser-Colby complex, gently undulating	-	-	-	-	SSb	Spearfish-Clapper complex, hilly	-	Wr	Wayden complex, hilly
CC	-	Castner-Reeder loams, rolling	-	Gi	Glenberg fine sandy loam, 2 to 4 percent slopes	-	Kk	Keiser-Colby complex, gently undulating	-	-	-	-	SSc	Spearfish-Clapper complex, hilly	-	Ws	Wayden complex, hilly
CD	-	Castner-Rock outcrop complex, rolling	-	Gj	Glenberg fine sandy loam, 4 to 8 percent slopes	KR	-	Keiser-Colby complex, gently undulating	-	Pa	Parshall fine sandy loam, 4 to 8 percent slopes	-	SSd	Spearfish-Clapper complex, hilly	-	-	Wayden complex, hilly
-	Ce	Cherry silty clay loam, 2 to 8 percent slopes	-	Gk	Glenberg fine sandy loam, 4 to 8 percent slopes	-	Kl	Keiser-Colby complex, gently undulating	-	Pd	Peritsa silt loam, undulating	-	St	Spearfish-Pultney association, rolling	WT	-	Wayden complex, hilly
-	Cf	Chugter loam, 2 to 8 percent slopes	-	Gm	Glenberg loam, 0 to 2 percent slopes	-	Km	Keiser-Colby complex, gently undulating	-	Pe	Peritsa silt loam, rolling	SU	-	Spearfish-Pultney association, rolling	WU	-	Wayden complex, hilly
CG	-	Chugter complex, 2 to 15 percent slopes	-	Gn	Glenberg loam, 2 to 4 percent slopes	-	Kn	Keiser-Colby complex, gently undulating	-	PF	Peritsa complex, rolling	SVa	-	Spearfish-Pultney association, rolling	WV	-	Wayden complex, hilly
CH	-	Clapper-Harvey complex, rolling	-	Go	Glenberg loam, 4 to 8 percent slopes	-	Ko	Keiser-Colby complex, gently undulating	-	Pg	Pierre clay, undulating	SVb	-	Spearfish-Pultney association, rolling	WW	-	Wayden complex, hilly
CK	-	Clapper-Midway complex, hilly	GS	-	Glenberg loam, 8 to 15 percent slopes	-	Kp	Keiser-Colby complex, gently undulating	-	Ph	Pierre clay, rolling	-	Swa	Spearfish-Pultney association, rolling	WX	-	Wayden complex, hilly
-	Cm	Colby silt loam, 4 to 8 percent slopes	-	Gp	Glenberg loam, 15 to 35 percent slopes	-	Kq	Keiser-Colby complex, gently undulating	-	Pk	Pierre-Kyle clays, gently undulating	-	Swb	Spearfish-Pultney association, rolling	-	Wy	Wayden complex, hilly
-	Cn	Colby silt loam, 8 to 15 percent slopes	-	Gq	Glenberg loam, 15 to 35 percent slopes	-	Kr	Keiser-Colby complex, gently undulating	-	PM	Pierre-Kyle clays, gently undulating	SX	-	Spearfish-Pultney association, rolling	-	Xa	Xavier silty clay loam, gently undulating
-	Co	Colby silty clay loam, 1 to 4 percent slopes	HA	-	Hanson extremely stony loam, rolling	LCa	-	Keiser-Colby complex, gently undulating	-	PN	Pierre-Lismaa clays, rolling	-	Taa	Talag clay, 0 to 8 percent slopes	-	Xc	Xavier silty clay loam, undulating
-	Cp	Colby silty clay loam, 4 to 8 percent slopes	HB	-	Hanson-Babb association, very steep	Lcb	-	Keiser-Colby complex, gently undulating	-	PO	Pultney-Neville association, undulating	-	Tab	Talag-Allentine complex, 0 to 4 percent slopes	-	Xe	Xavier silty clay loam, rolling
-	Cr	Colby silty clay loam, 8 to 15 percent slopes	-	Hca	Harvey loam, gently undulating	Lcc	-	Keiser-Colby complex, gently undulating	-	-	-	-	Tb	Tarrete silty clay loam, 8 to 15 percent slopes	-	Xh	Xavier-Shaak complex, undulating
-	Cs	Colby-Beauvais silt loams, undulating	-	-	-	Lcd	-	Keiser-Colby complex, gently undulating	-	-	-	-	-	-	-	Xi	Xavier-Shaak complex, rolling
-	Ct	Colby-Beauvais silt loams, rolling	-	-	-	Lcd	-	Keiser-Colby complex, gently undulating	-	-	-	-	-	-	-	Xj	Xavier-Shaak complex, rolling

# BIG HORN COUNTY AREA, MONTANA




## CONVENTIONAL SIGNS

### WORKS AND STRUCTURES

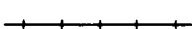
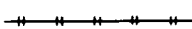
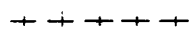
#### Highways and roads

Divided .....	
Good motor .....	
Poor motor .....	
Trail .....	





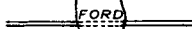


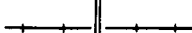
#### Highway markers

National Interstate .....	
U. S. ....	
State or county .....	



#### Railroads

Single track .....	
Multiple track .....	
Abandoned .....	

#### Bridges and crossings

Road .....	
Trail .....	
Railroad .....	
Ferry .....	
Ford .....	
Grade .....	
R. R. over .....	
R. R. under .....	

#### Buildings

School .....	
Church .....	

#### Mine and quarry



#### Gravel pit



#### Well and water trough



#### Windmill and water trough



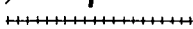
#### Cemetery



#### Dams



#### Levee



#### Tanks



#### Well, oil or gas



#### Forest fire or lookout station








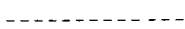
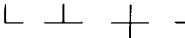
#### Windmill




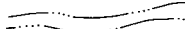

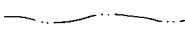


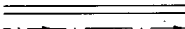

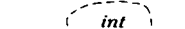




#### Located object










### BOUNDARIES

National or state .....	
County .....	
Minor civil division .....	
Reservation .....	
Limit of soil survey .....	
Small park, cemetery, airport .....	
Land survey division corners .....	

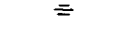

### DRAINAGE

Streams, double-line	
Perennial .....	
Intermittent .....	
Streams, single-line	
Perennial .....	
Intermittent	
Crossable with tillage implements .....	
Not crossable with tillage implements .....	
Unclassified .....	
Canals or single line irrigation ditches .....	
Lakes and ponds	
Perennial .....	
Intermittent .....	
Spring .....	
Marsh or swamp .....	
Wet spot .....	
Drainage end or alluvial fan .....	

### RELIEF

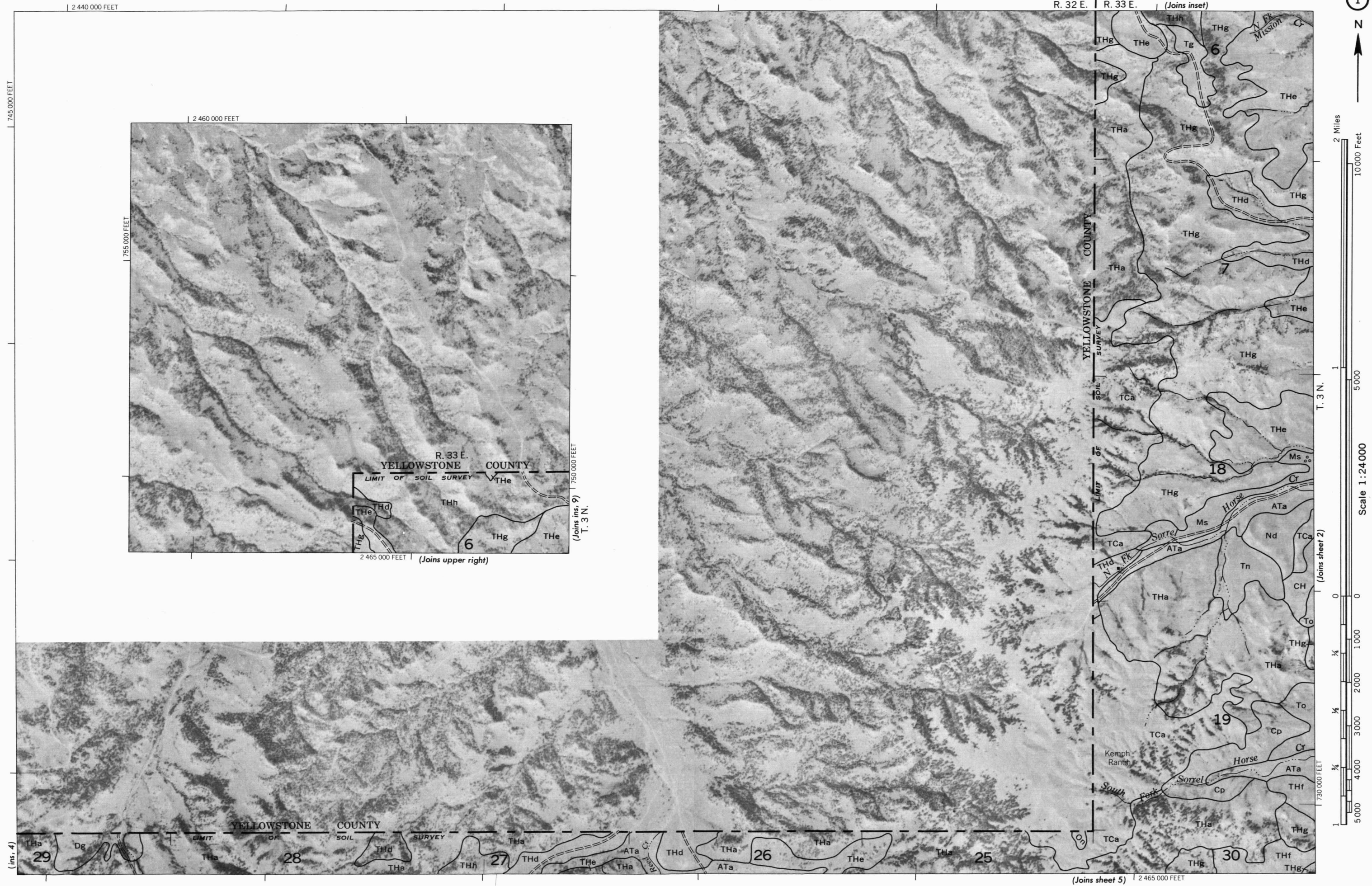
Escarpments	
Bedrock .....	
Other .....	
Short steep slope .....	
Prominent peak .....	
Depressions	
Crossable with tillage implements .....	
Not crossable with tillage implements .....	
Contains water most of the time .....	

### SOIL SURVEY DATA

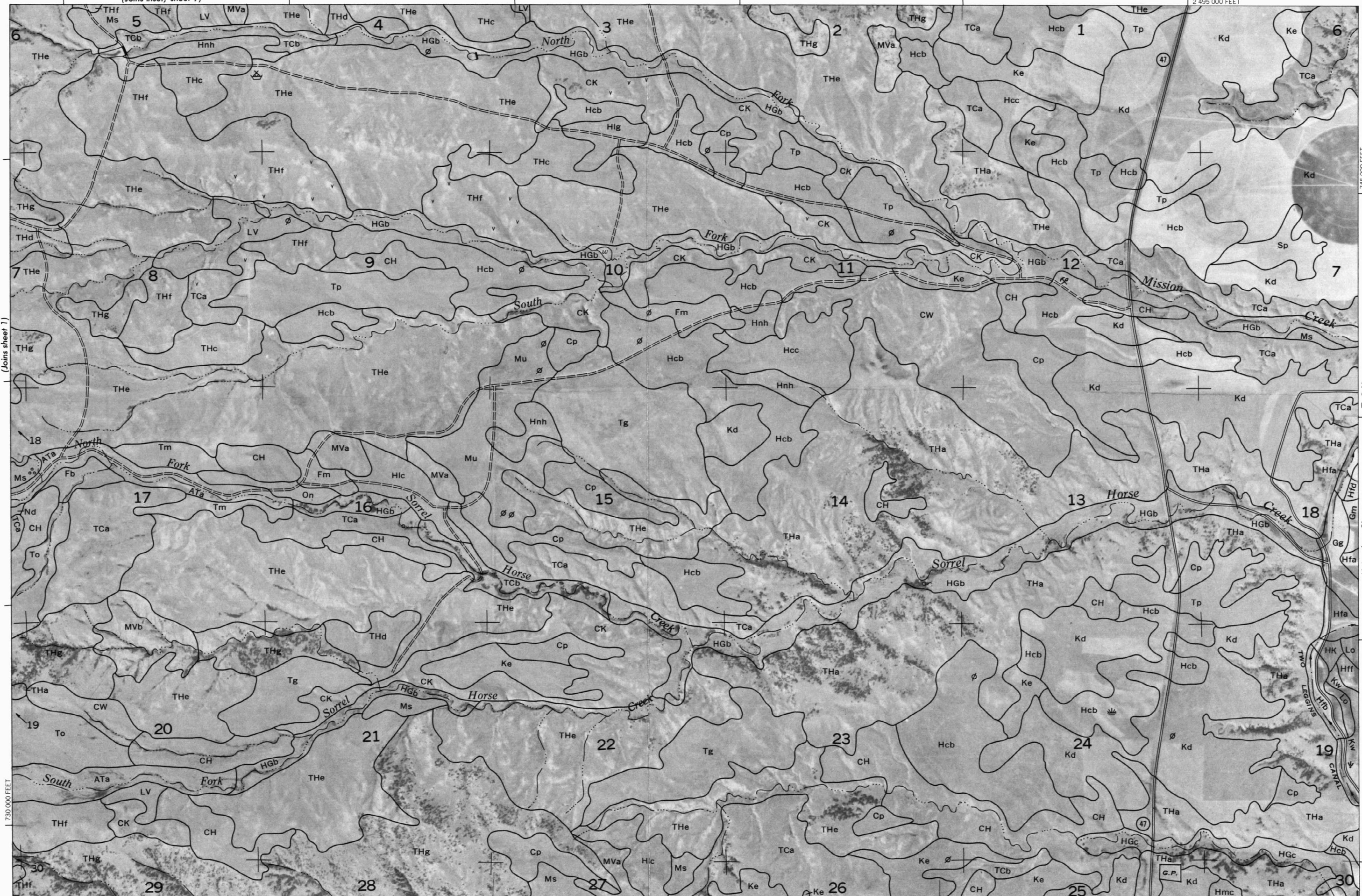
Soil boundary and symbol .....	
Gravel .....	
Stoniness { Stony .....	
{ Very stony .....	
Rock outcrops .....	
Chert fragments .....	
Clay spot .....	
Sand spot .....	
Gumbo or scabby spot .....	
Made land .....	
Severely eroded spot .....	
Blowout, wind erosion .....	
Gully .....	
Borrow pit .....	



This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.







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2 Miles

10 000 Feet

1

5000

Scale 1:24 000

0

0

1000

2000

3000

4000

5000

1/4

1/2

3/4

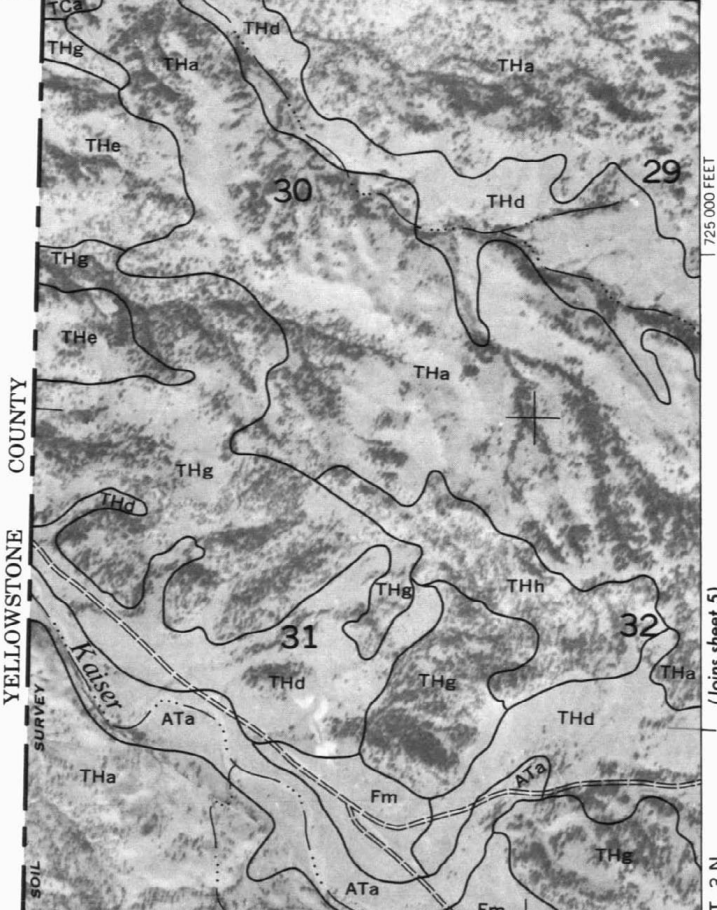
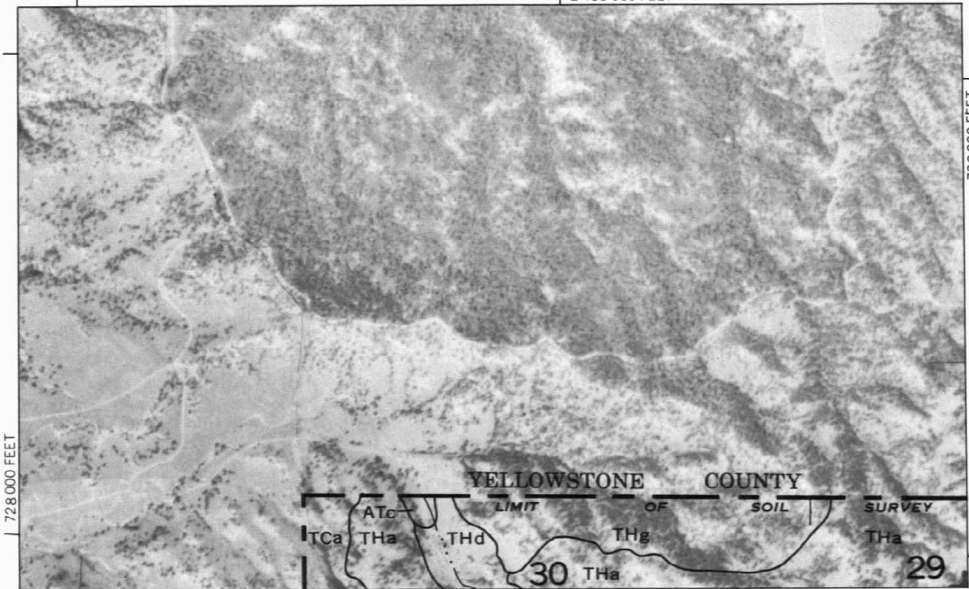
1

5000

1

710 000 FEET

2 410 000 FEET



(Joins sheet 5)

T. 2 N. | T. 3 N.

(Joins sheet 11)



BIG HORN COUNTY AREA, MONTANA NO. 5







(Joins sheet 2)

2 495 000 FEET

1 771 000 676 1

T. 2 N. | T. 3 N.

(Joins sheet 7)

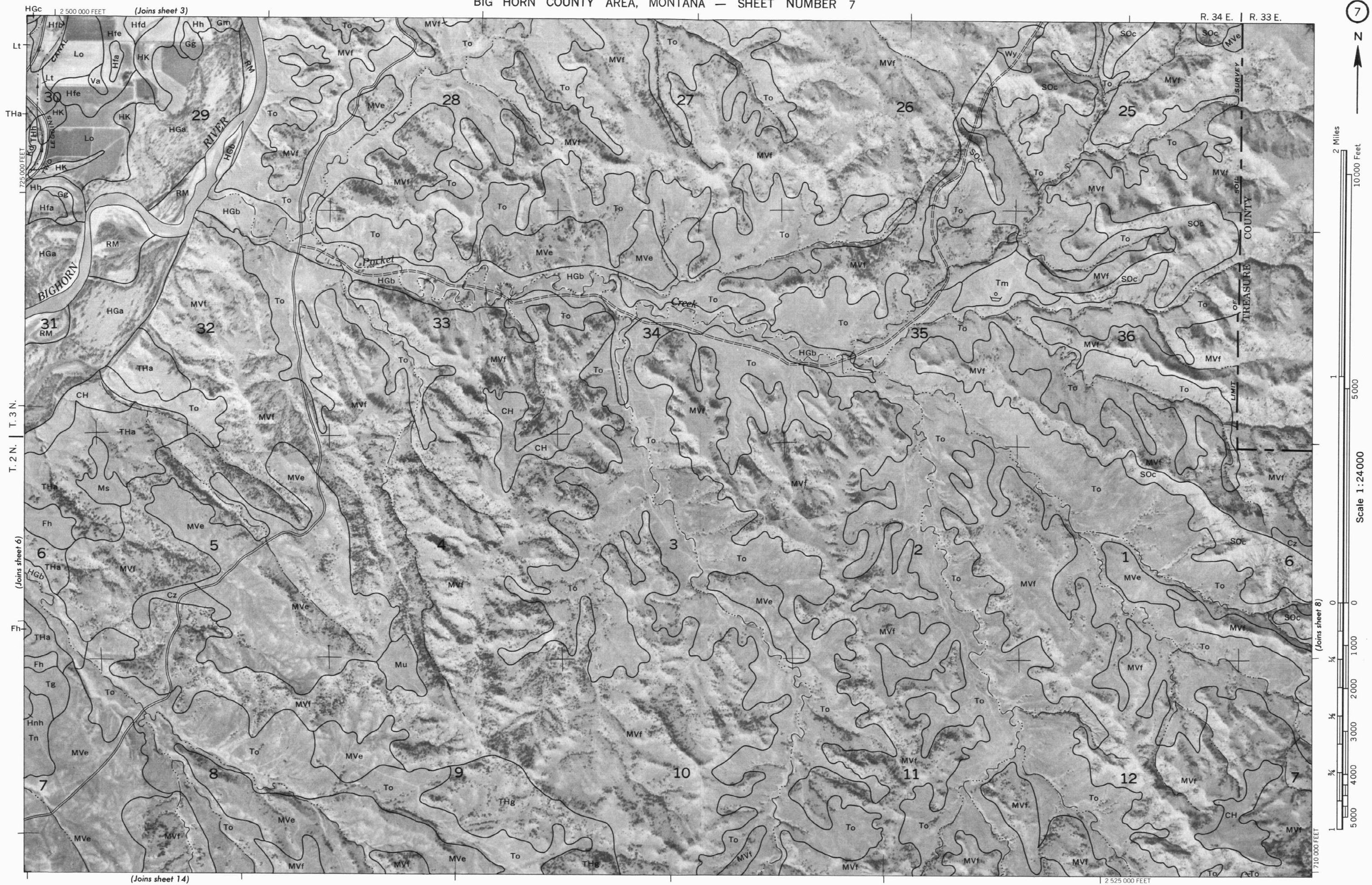
(Joins sheet 13)

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BIG HORN COUNTY AREA, MONTANA NO. 6



This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.







Scale 1:24 000

1

0

0

0

0

1

5 000

10 000

15 000

20 000

25 000

30 000

35 000

40 000

45 000

50 000

55 000

60 000

65 000

70 000

75 000

80 000

85 000

90 000

95 000

100 000

105 000

110 000

115 000

120 000

125 000

130 000

135 000

140 000

145 000

150 000

155 000

160 000

165 000

170 000

175 000

180 000

185 000

190 000

195 000

200 000

205 000

210 000

215 000

220 000

225 000

230 000

235 000

240 000

245 000

250 000

255 000

260 000

265 000

270 000

275 000

280 000

285 000

290 000

295 000

300 000

305 000

310 000

315 000

320 000

325 000

330 000

335 000

340 000

345 000

350 000

355 000

360 000

365 000

370 000

375 000

380 000

385 000

390 000

395 000

400 000

405 000

410 000

415 000

420 000

425 000

430 000

435 000

440 000

445 000

450 000

455 000

460 000

465 000

470 000

475 000

480 000

485 000

490 000

495 000

500 000

505 000

510 000

515 000

520 000

525 000

530 000

535 000

540 000

545 000

550 000

555 000

560 000

565 000

570 000

575 000

580 000

585 000

590 000

595 000

600 000

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610 000

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620 000

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635 000

640 000

645 000

650 000

655 000

660 000

665 000

670 000

675 000

680 000

685 000

690 000

695 000

700 000

705 000

710 000

715 000

720 000

725 000

730 000

735 000

740 000

745 000

750 000

755 000

760 000

765 000

770 000

775 000

780 000

785 000

790 000

795 000

800 000

805 000

810 000

815 000

820 000

825 000

830 000

835 000

840 000

845 000

850 000

855 000

860 000

865 000

870 000

875 000

880 000

885 000

890 000

895 000

900 000

905 000

910 000

915 000

920 000

925 000

930 000

935 000

940 000

945 000

950 000

955 000

960 000

965 000

970 000

975 000

980 000

985 000

990 000

995 000

1000 000

1005 000

1010 000

1015 000

1020 000

1025 000

1030 000

1035 000

1040 000

1045 000

1050 000

1055 000

1060 000

1065 000

1070 000

1075 000

1080 000

1085 000

1090 000

1095 000

1100 000

1105 000

1110 000

1115 000

1120 000

1125 000

1130 000

1135 000

1140 000

1145 000

1150 000

1155 000

1160 000

1165 000

1170 000

1175 000

1180 000

1185 000

1190 000

1195 000

1200 000

1205 000

1210 000

1215 000

1220 000

1225 000

1230 000

1235 000

1240 000

1245 000

1250 000

1255 000

1260 000

1265 000

1270 000

1275 000

1280 000

1285 000

1290 000

1295 000

1300 000

1305 000

1310 000

1315 000

1320 000

1325 000

1330 000

1335 000

1340 000

1345 000

1350 000

1355 000

1360 000

1365 000

1370 000

1375 000

1380 000

1385 000

1390 000

1395 000

1400 000

1405 000

1410 000

1415 000

1420 000

1425 000

1430 000

1435 000

1440 000

1445 000

1450 000

1455 000

1460 000

1465 000

1470 000

1475 000

1480 000

1485 000

1490 000

1495 000

1500 000

1505 000

1510 000

1515 000

1520 000

1525 000

1530 000

1535 000

1540 000

1545 000

1550 000

1555 000

1560 000

1565 000

1570 000

1575 000

1580 000

1585 000

1590 000

1595 000

1600 000

1605 000

1610 000

1615 000

1620 000

1625 000

1630 000

1635 000

1640 000

1645 000

1650 000

1655 000

1660 000

1665 000

1670 000

1675 000

1680 000

1685 000

1690

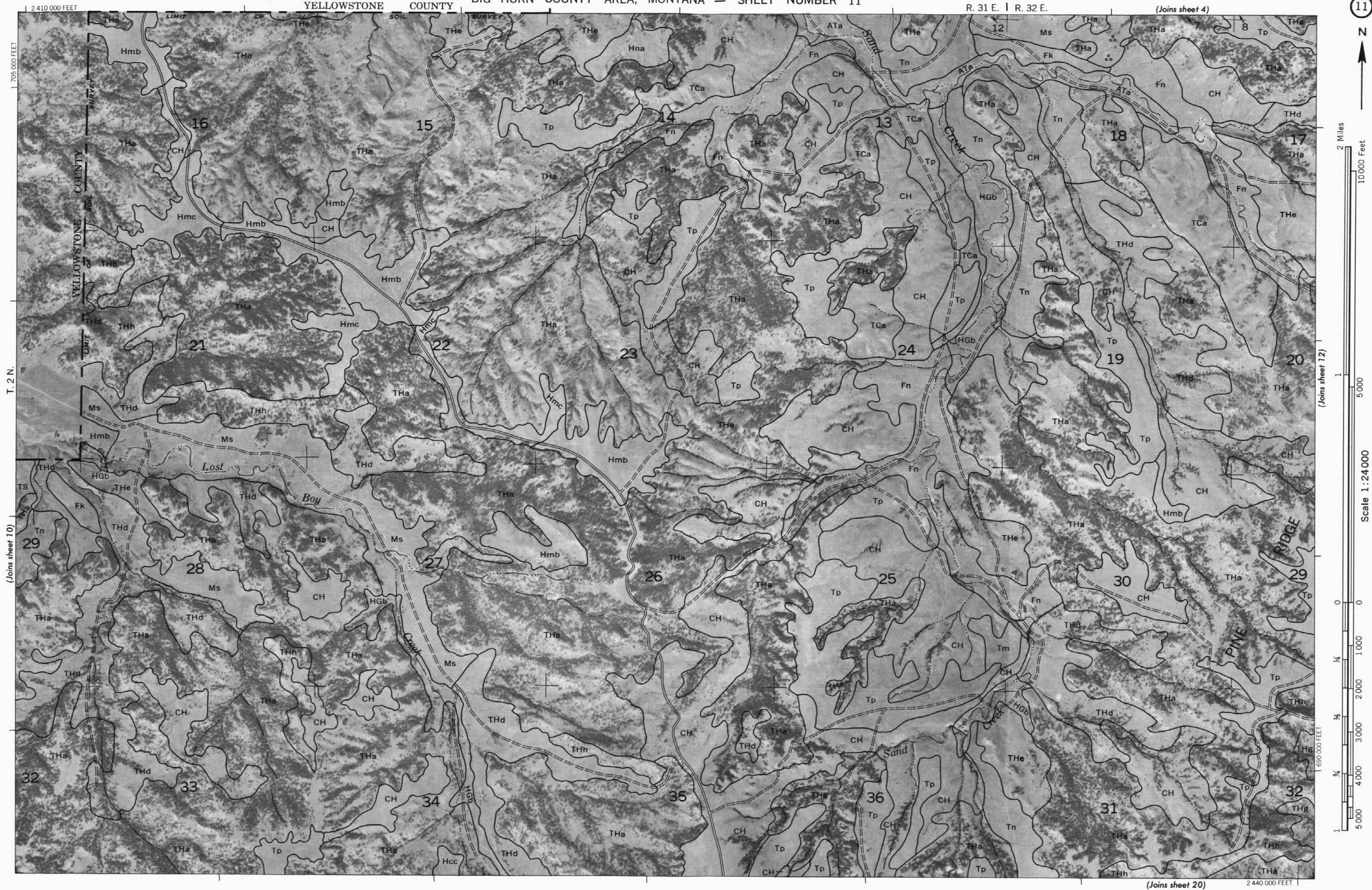














2 445 000 FEET



1  
5000

Scale 1:24000

	1/4	1/2	3/4	1
0				
1000				
2000				
3000				
4000				
5000				

(Joins sheet 21)

T. 2 N.

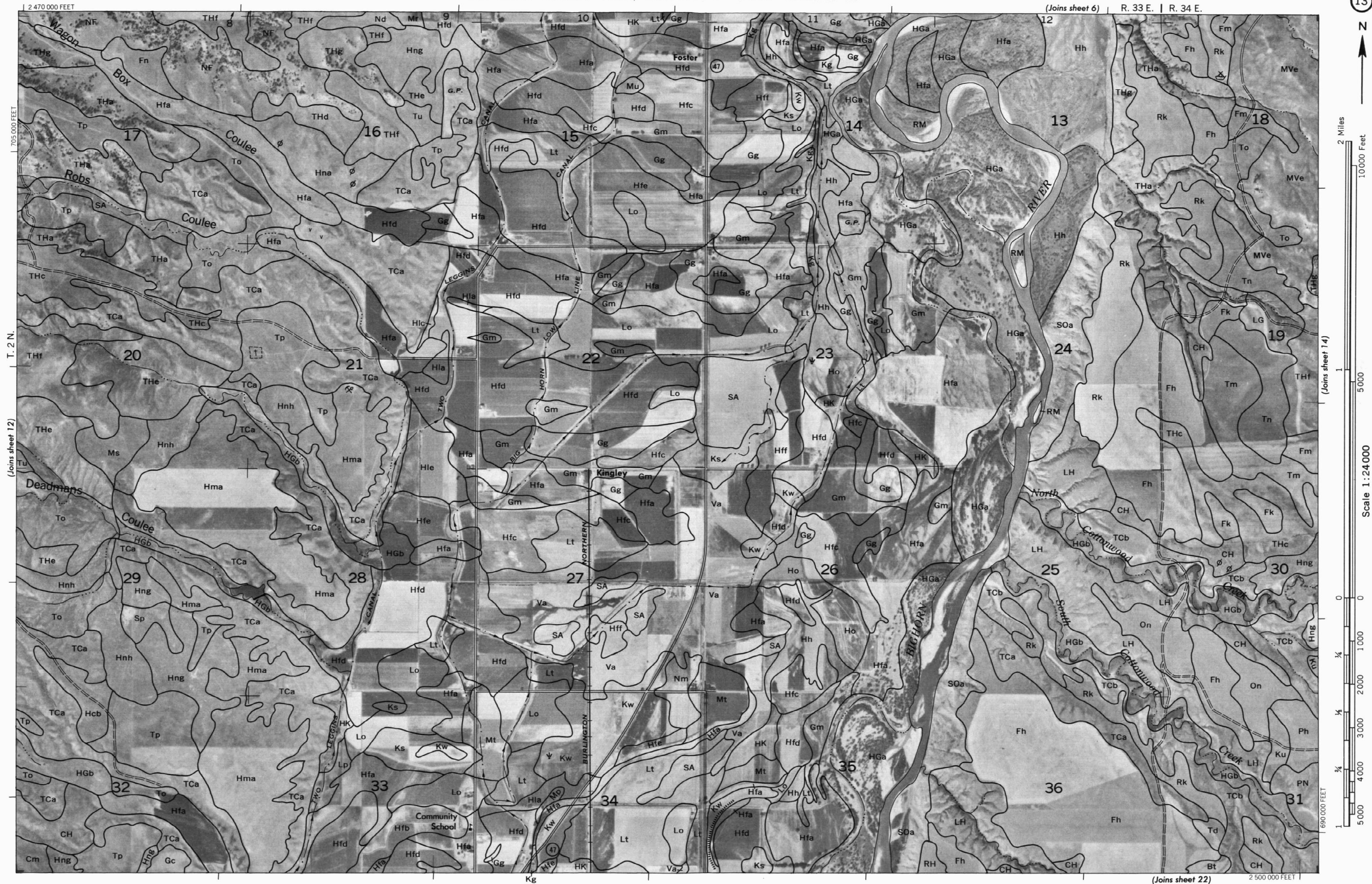
(Joins sheet 13)

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BIG HORN COUNTY AREA. MONTANA NO. 12



This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.





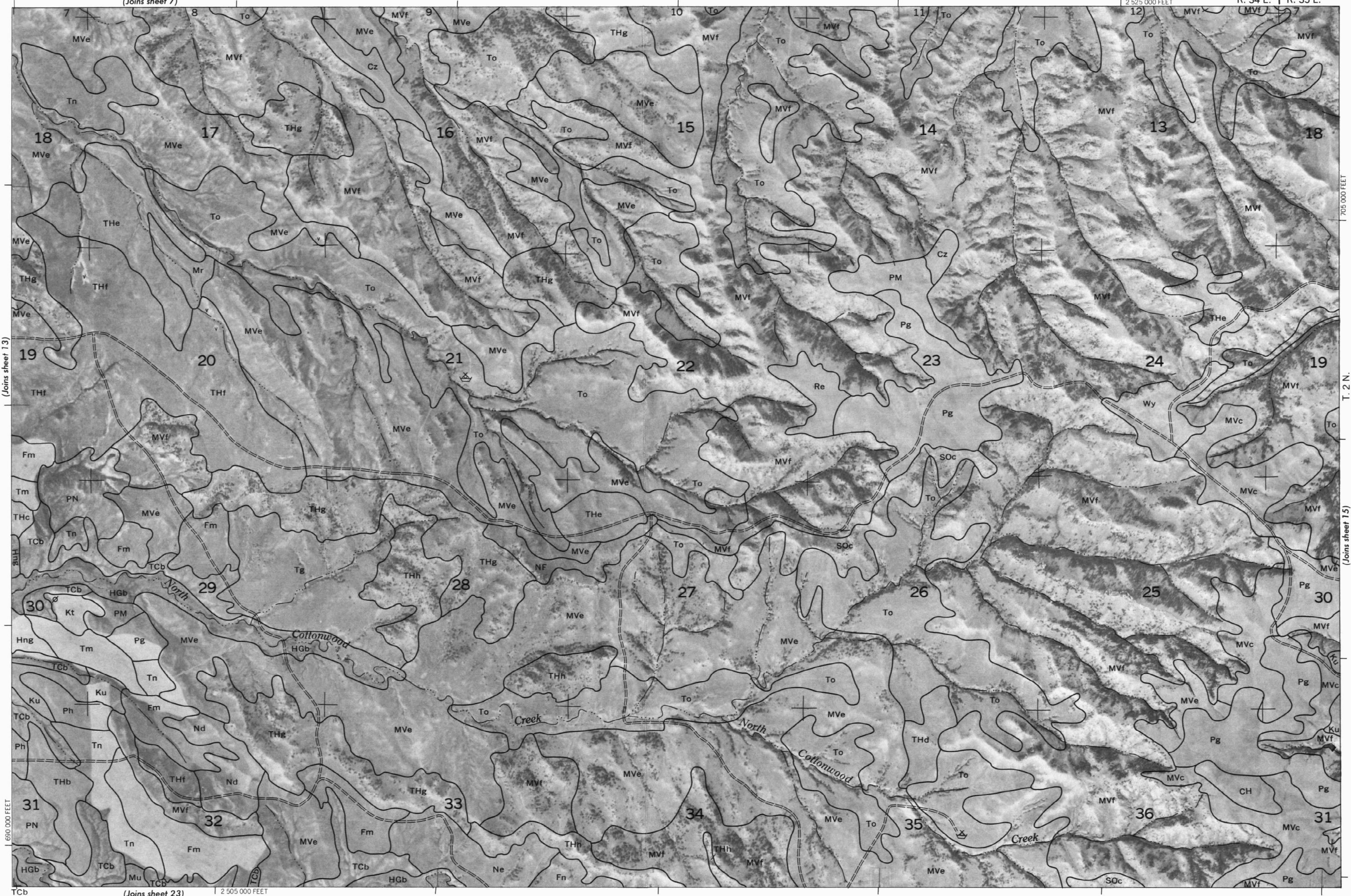


2 Miles  
10 000 Feet

1  
5 000

Scale 1:24 000

0 0  
1 000  
2 000  
3 000  
4 000  
5 000



(Joins sheet 7)

(Joins sheet 13)

(Joins sheet 15)

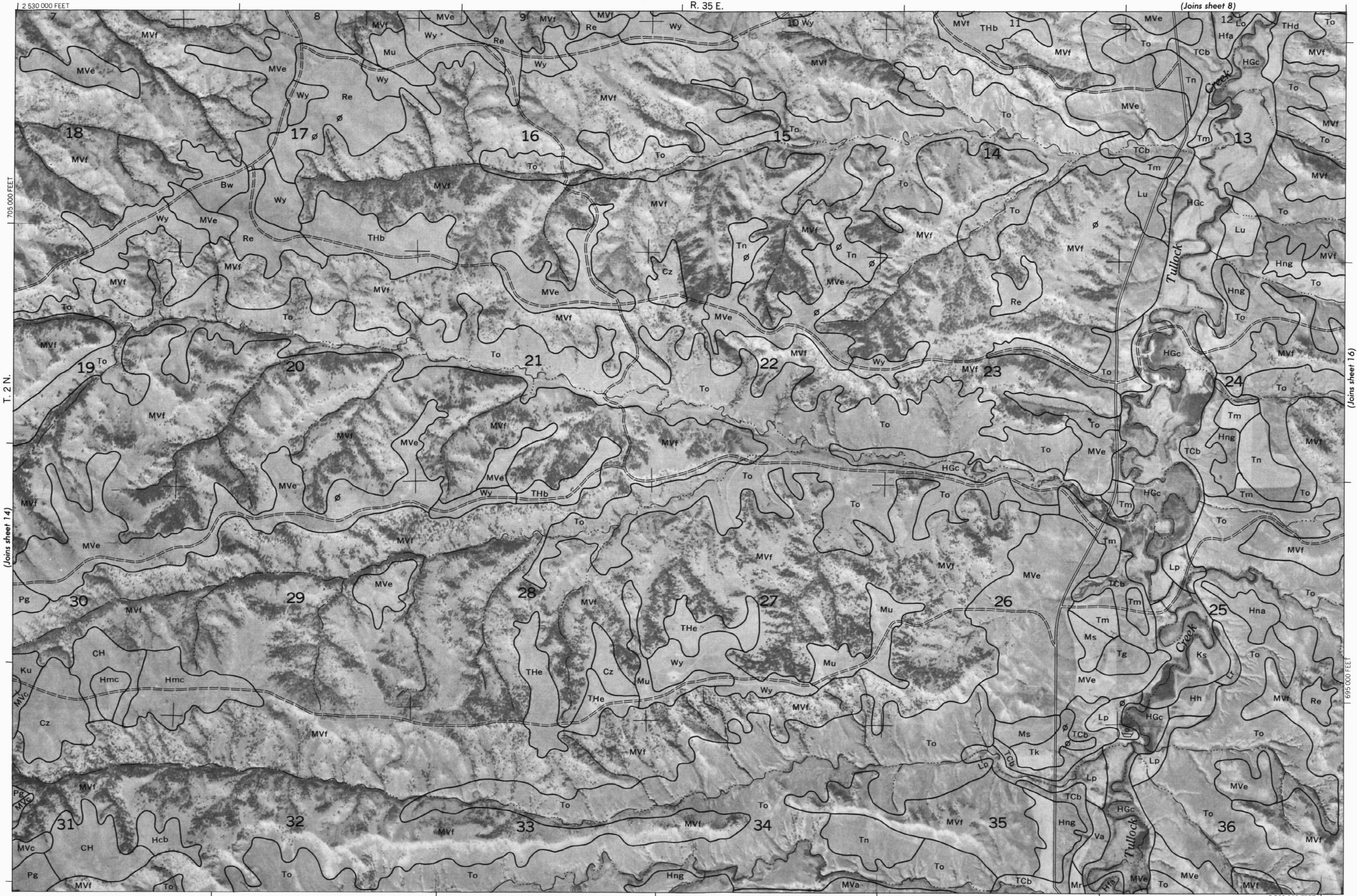




2 Miles  
10 000 Feet

1  
5 000  
Scale 1:24 000

1  
5 000  
0 1 000 2 000 3 000 4 000 5 000



This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

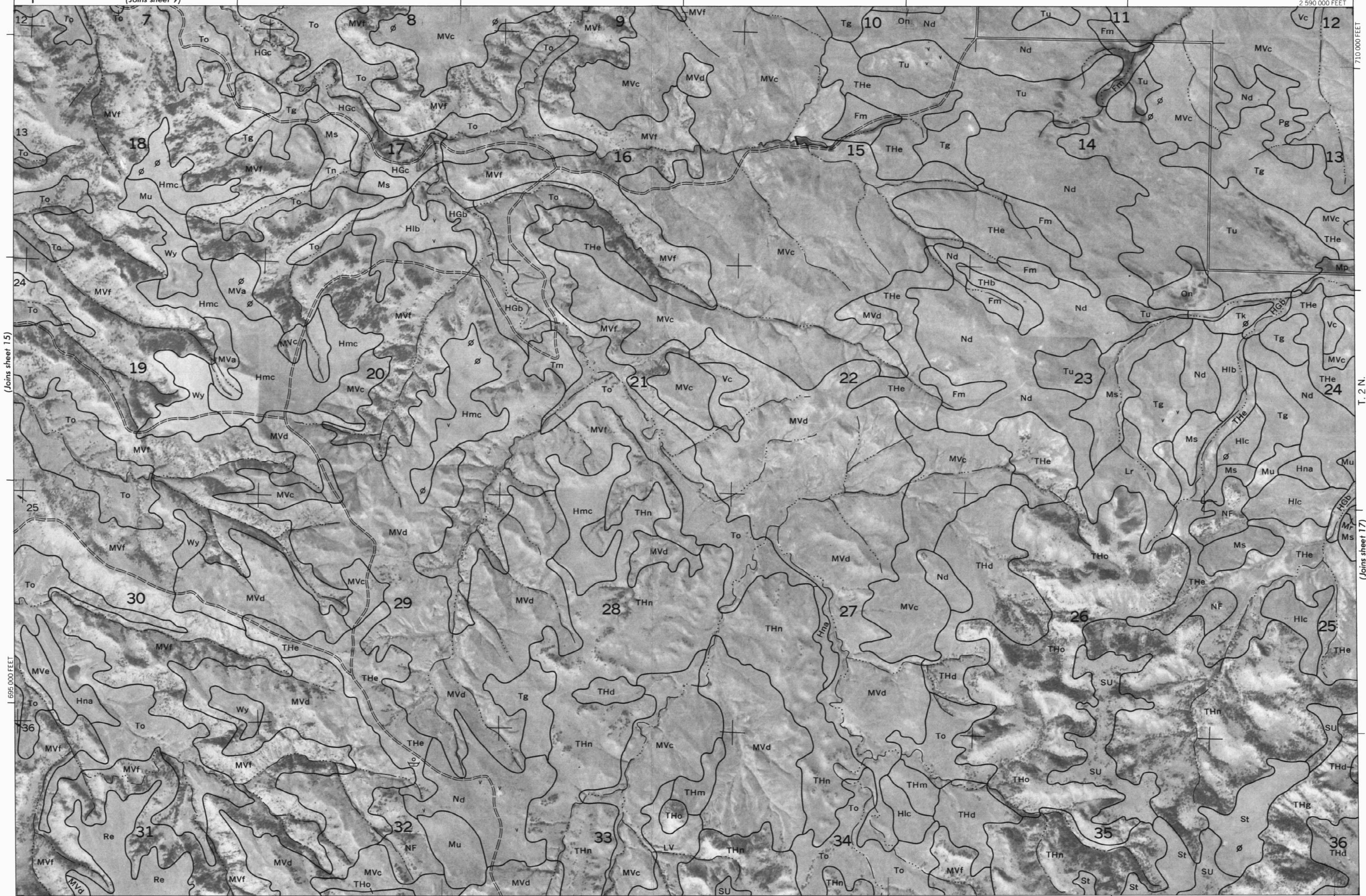
(Joins sheet 14)

(Joins sheet 16)



(Joins sheet 9)

2 590 000 FEET



(Joins sheet 25)

2 565 000 FEET

T. 2 N. (Joins sheet 17)

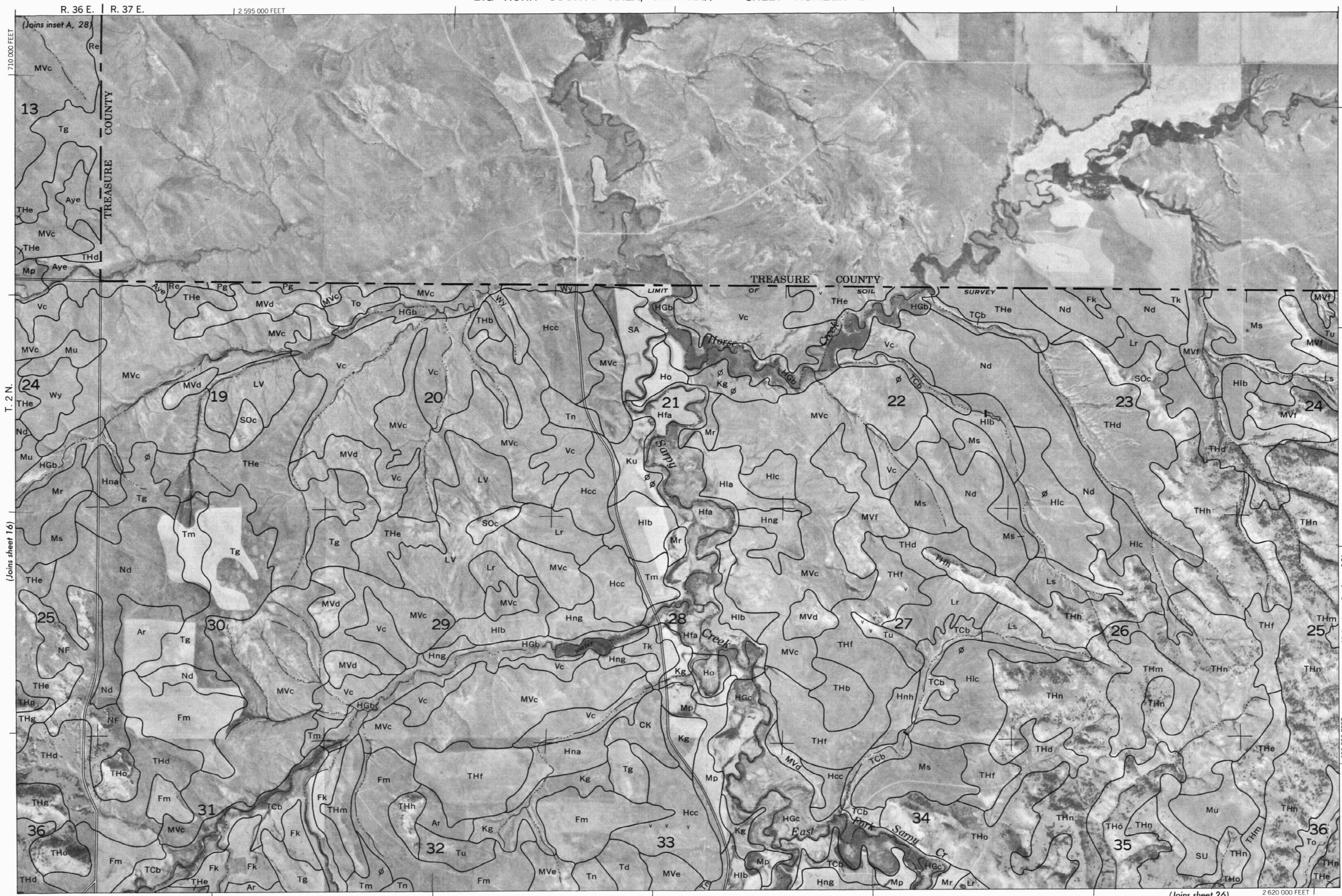
This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BIG HORN COUNTY AREA, MONTANA NO. 16



BIG HORN COUNTY AREA, MONTANA NO. 17

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



(Joins sheet 26) 2 620 000 FEET





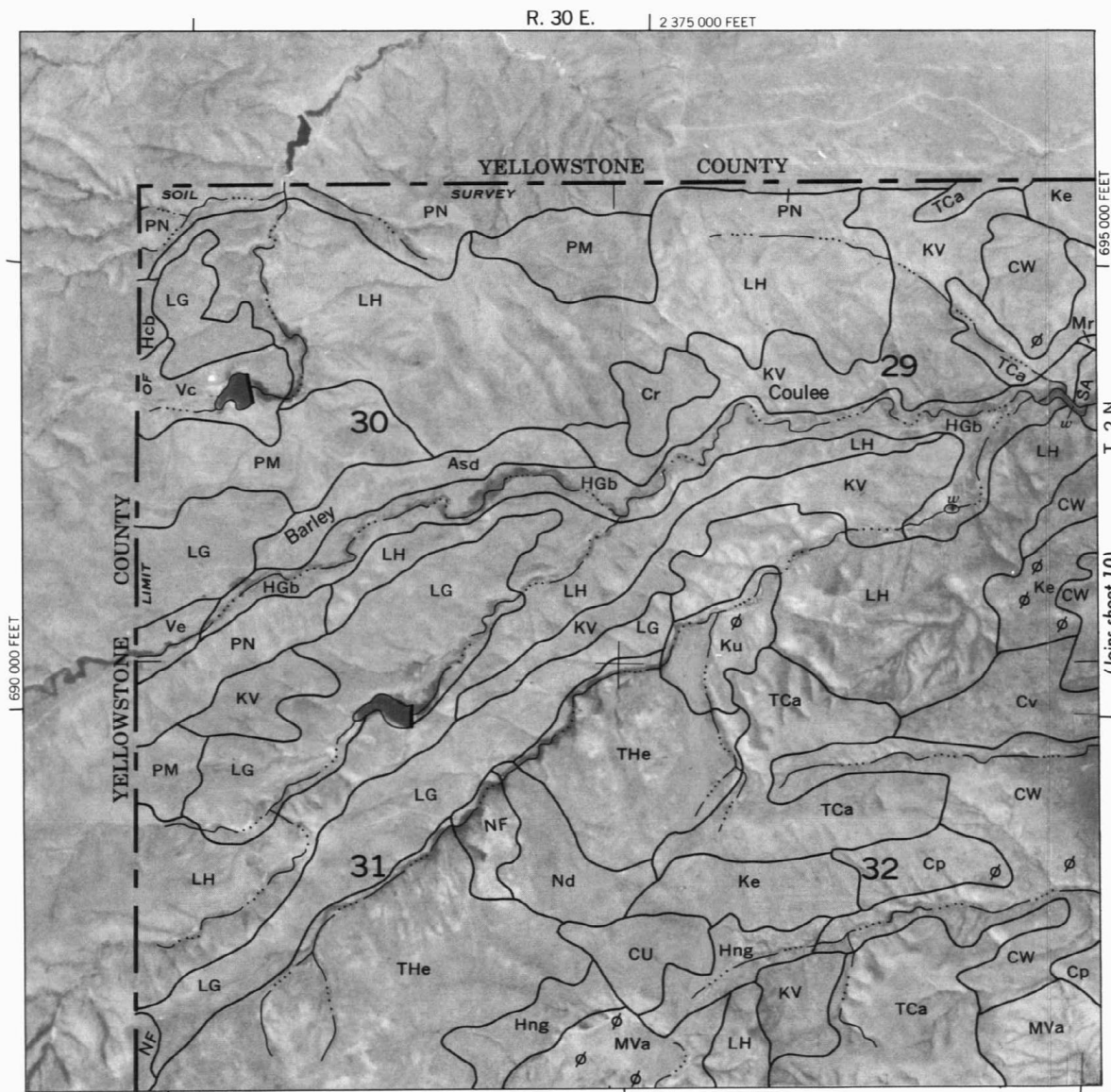
2 Miles  
10000 Feet

1  
5000

Scale 1:24000

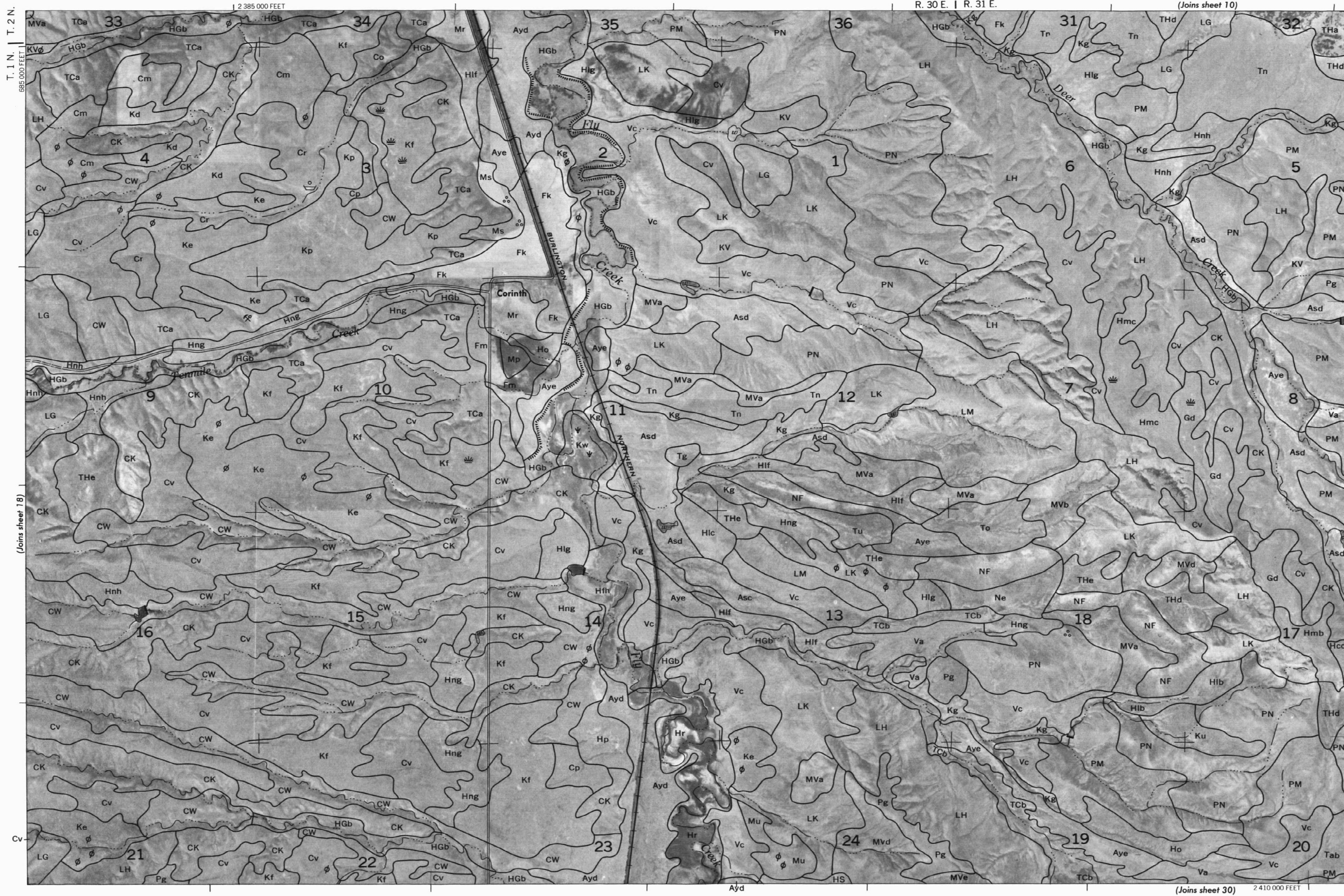
0 0 1000 2000 3000 4000 5000

670 000 FEET





This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.  
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



T. 1 N. | T. 2 N.  
685 000 FEET

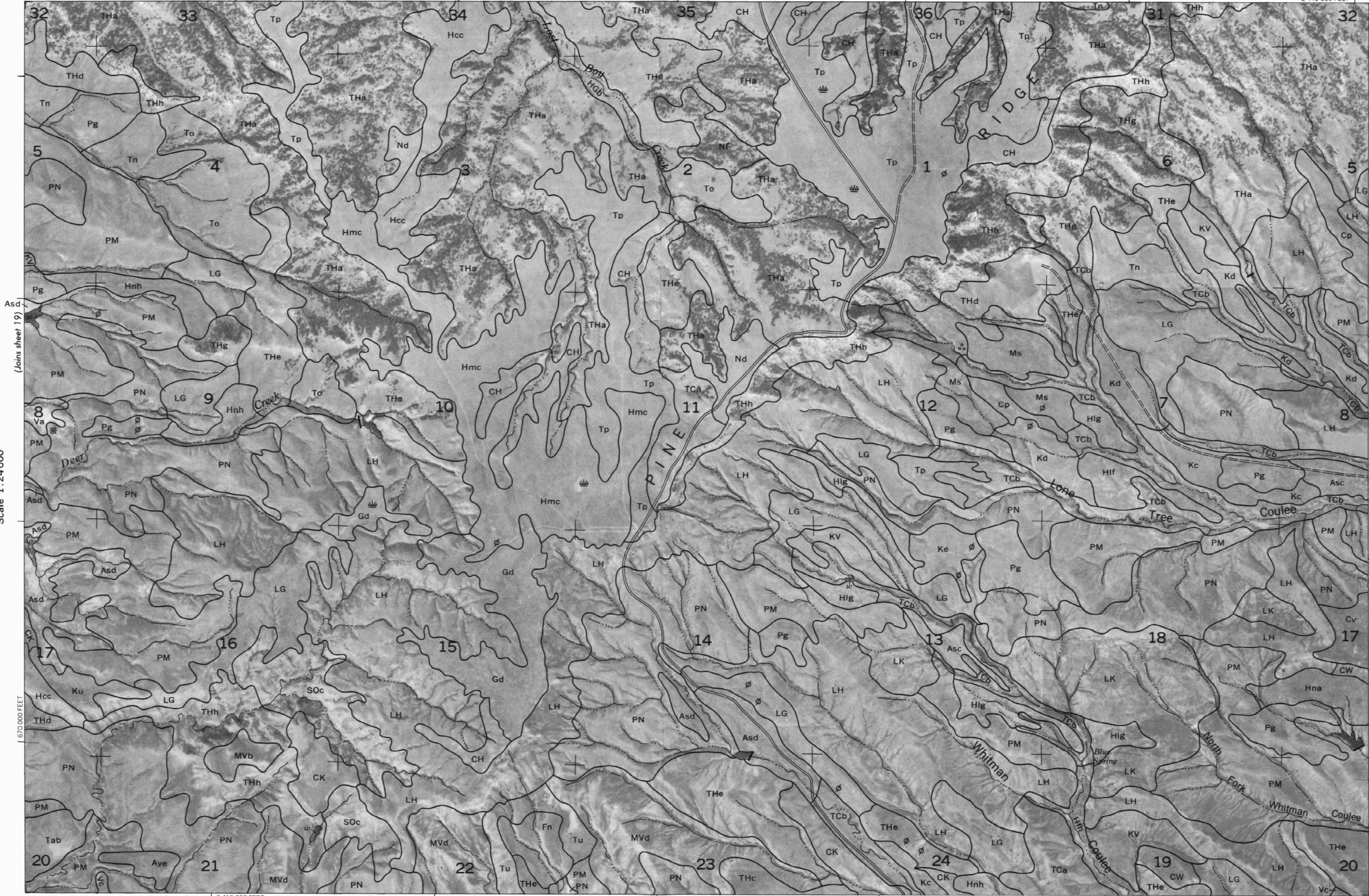
(Joins sheet 18)

(Joins sheet 20)

Scale 1:24000

670 000 FEET









2 Miles  
10000 Feet

1 5000

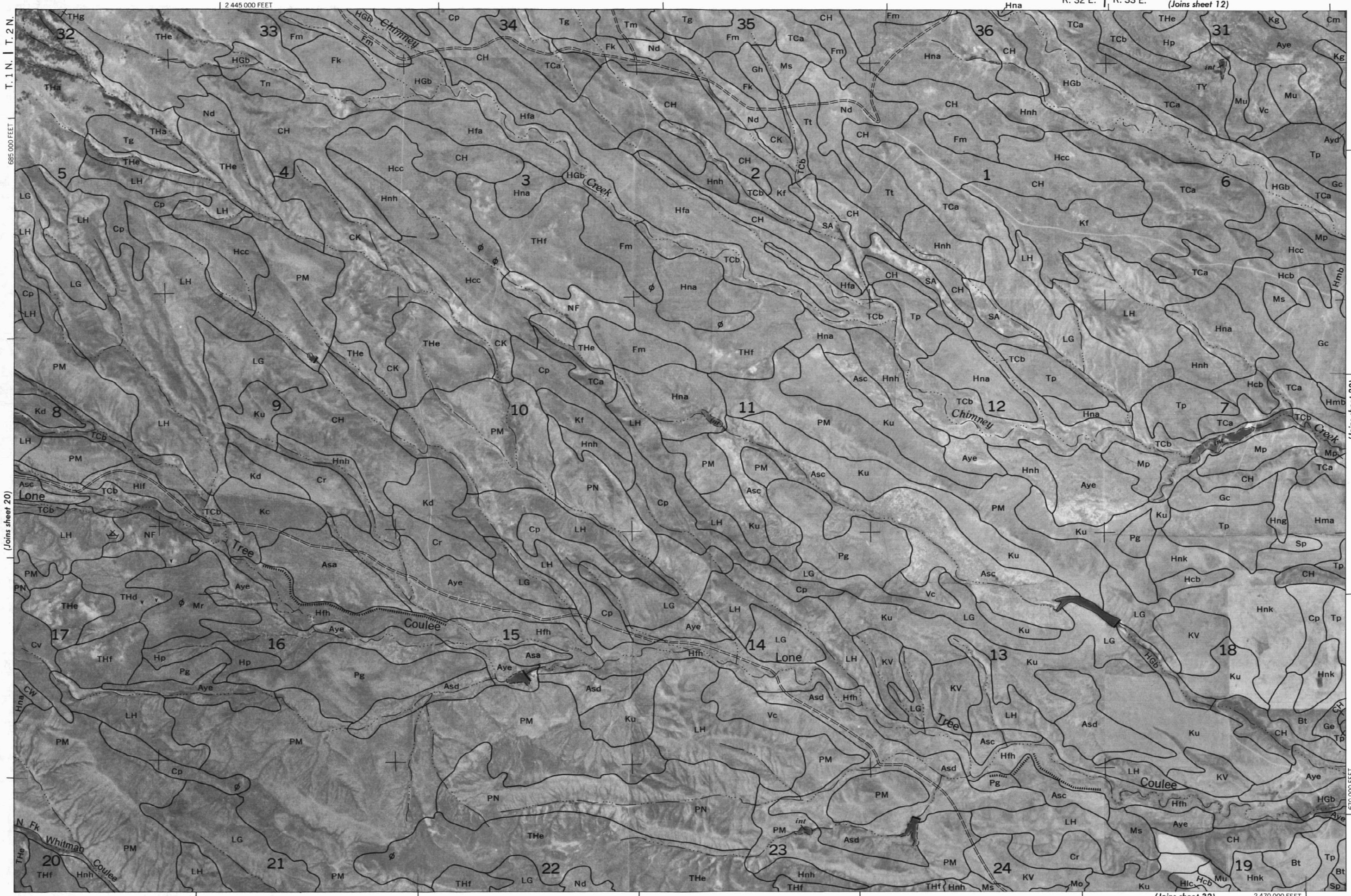
Scale 1:24000

0 0 1000 2000 3000 4000 5000  
1/4 1/2 3/4

670 000 FEET

(Joins sheet 32)

2 470 000 FEET



2 445 000 FEET

T. 1 N. | T. 2 N.

685 000 FEET

(Joins sheet 20)

Hna CW

N Fk

THf

BIG HORN COUNTY AREA, MONTANA NO. 21  
This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.  
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



(Joins sheet 13)



2 Miles

10000 Feet

1

5000

Scale 1:24 000

0

0

1000

2000

3000

4000

5000

1 670 000 FEET

1/4

1/2

3/4

1

1 1/4

1 1/2

1 3/4

2

2 1/4

2 1/2

2 3/4

3

3 1/4

3 1/2

3 3/4

4

4 1/4

4 1/2

4 3/4

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5 1/4

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6 1/4

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6 3/4

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7 1/4

7 1/2

7 3/4

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74 1/4

74 1/2

74 3/4

75

75 1/4

75 1/2

75 3/4

76

76 1/4

76 1/2

76 3/4

77

77 1/4

7



(Joins sheet 22)

(Joins sheet 34)

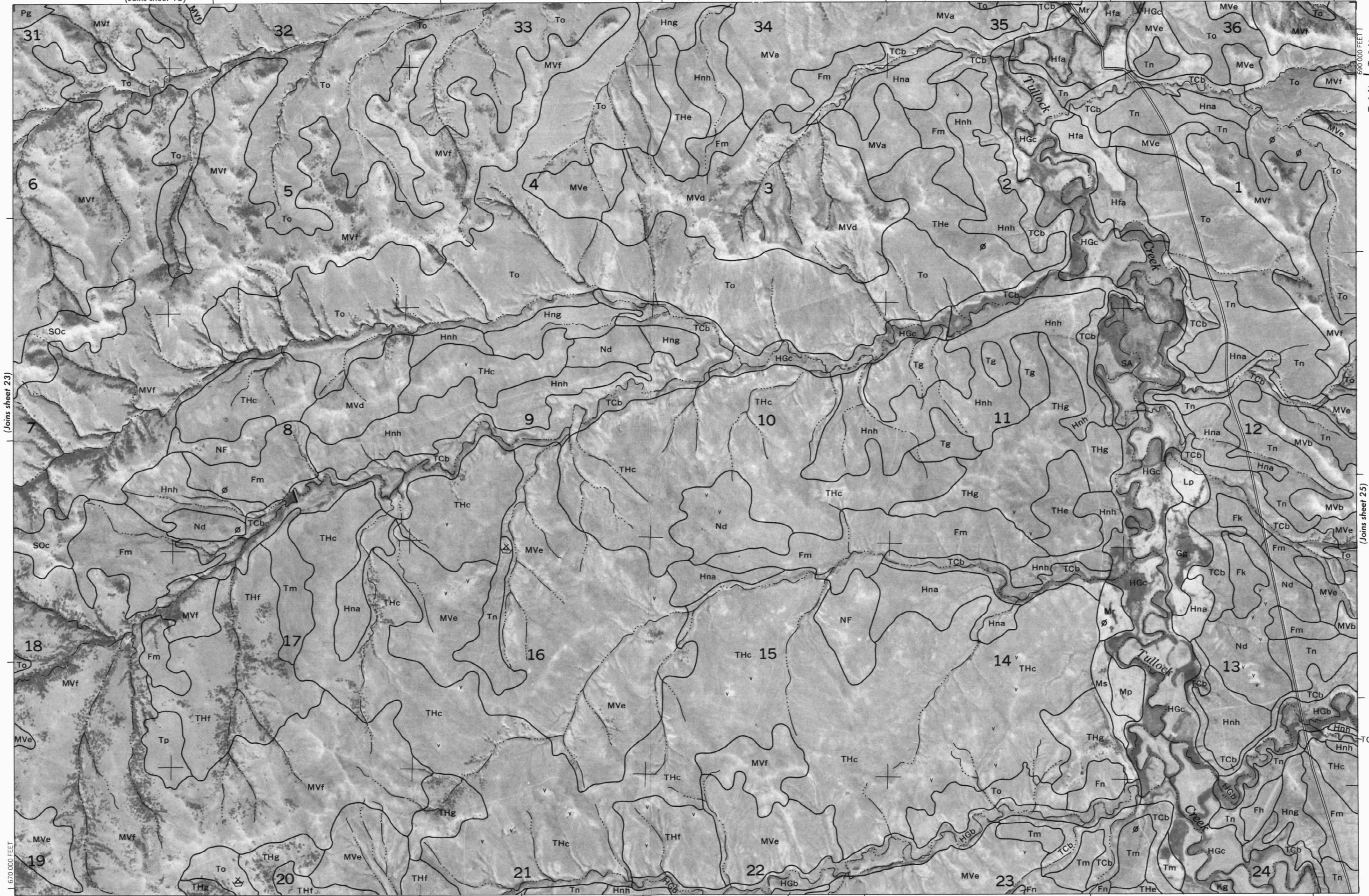
2 530 000 FEET |



R. 35 E.

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BIG HORN COUNTY AREA, MONTANA NO. 24









R. 36 E. | R. 37 E.

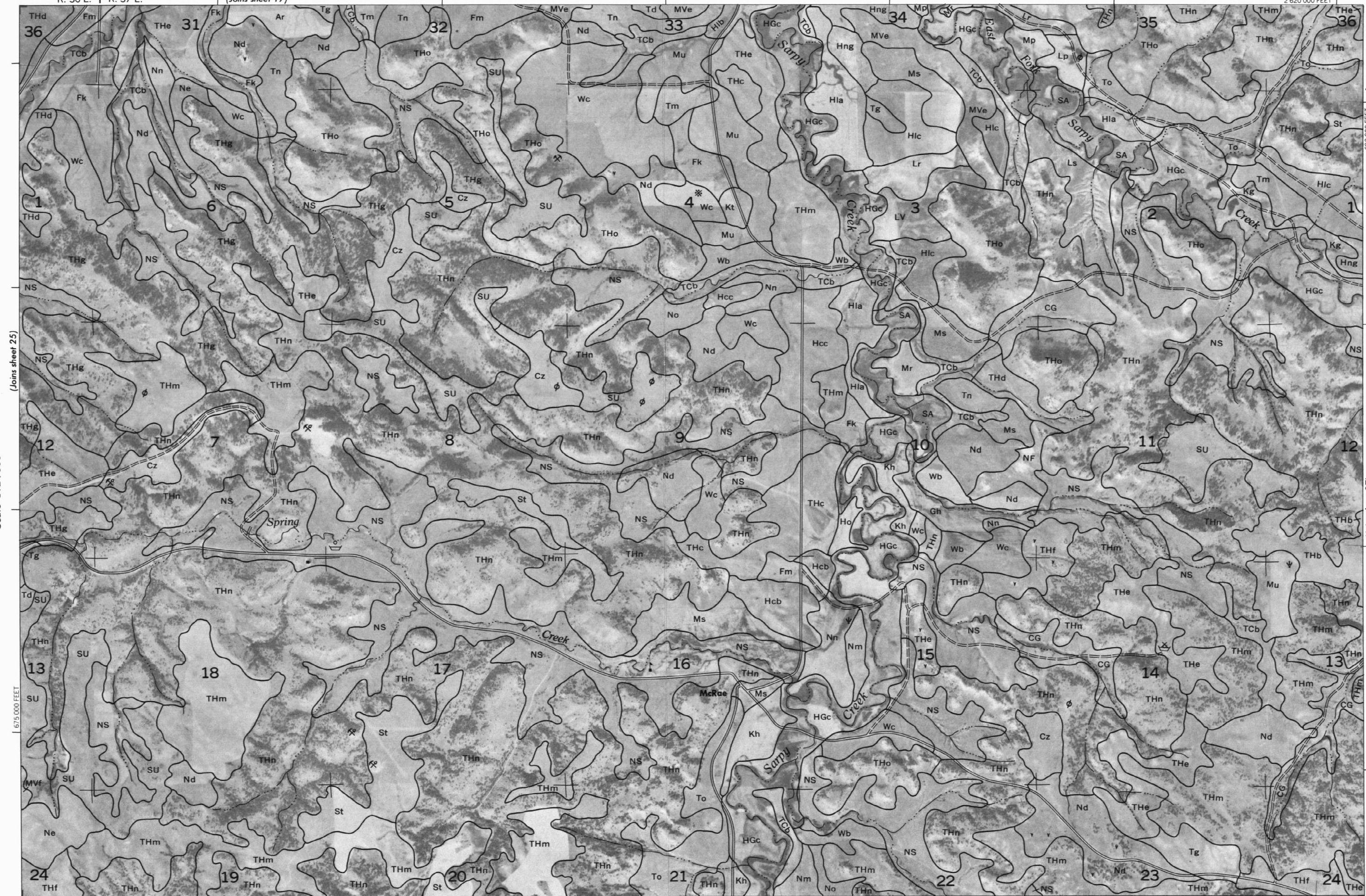
(Joins sheet 17)

2 620 000 FEET



Scale 1:24 000

(Joins sheet 25)



2 595 000 FEET (Joins sheet 37)

690 000 FEET

(Joins sheet 27)

T. 1 N. | T. 2 N.

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BIG HORN COUNTY AREA, MONTANA NO. 26



(Joins inset B, 28) R. 37 E. | R. 38 E. 2 625 000 FEET



(Joins sheet 38)

2 650 000 FEET

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BIG HORN COUNTY AREA, MONTANA NO. 27



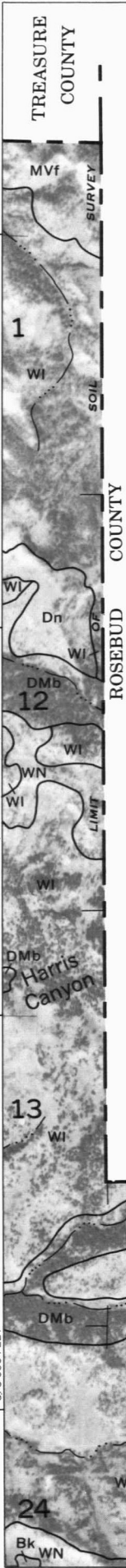
R. 38 E. | R. 39 E.

2 680 000 FEET



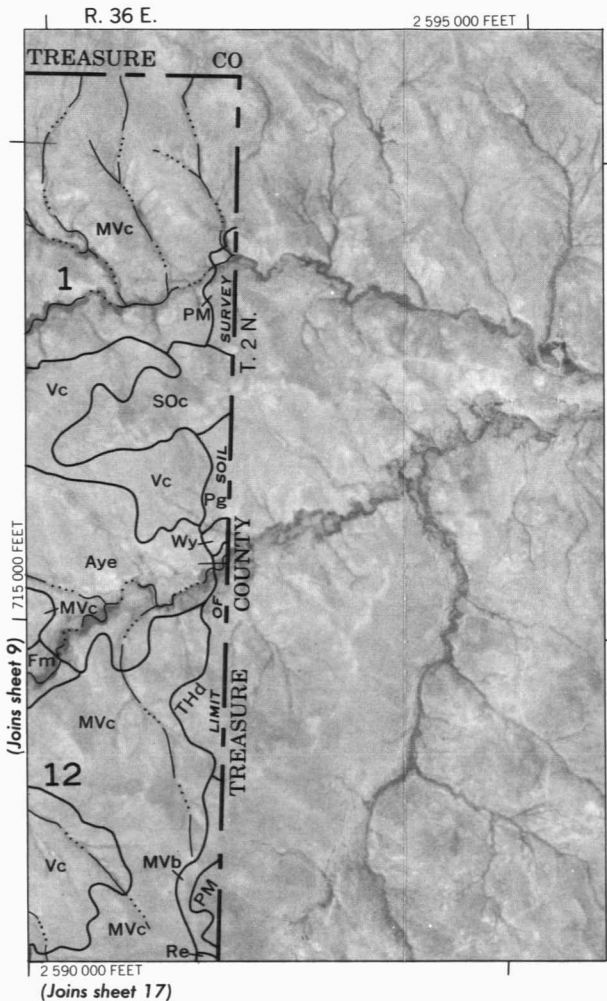
Scale 1:24 000

(Joins sheet 27)

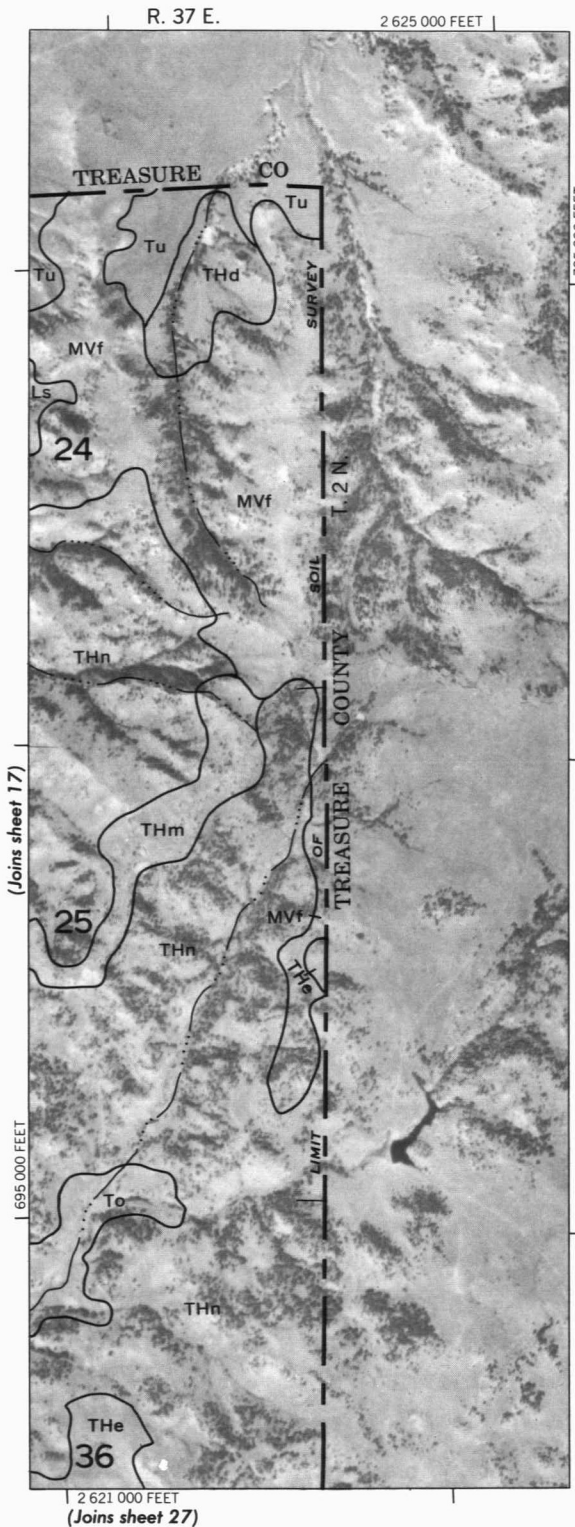


(Joins sheet 39) | 2 655 000 FEET

INSET A



INSET B



4000 AND 5000-FOOT GRID TICKS



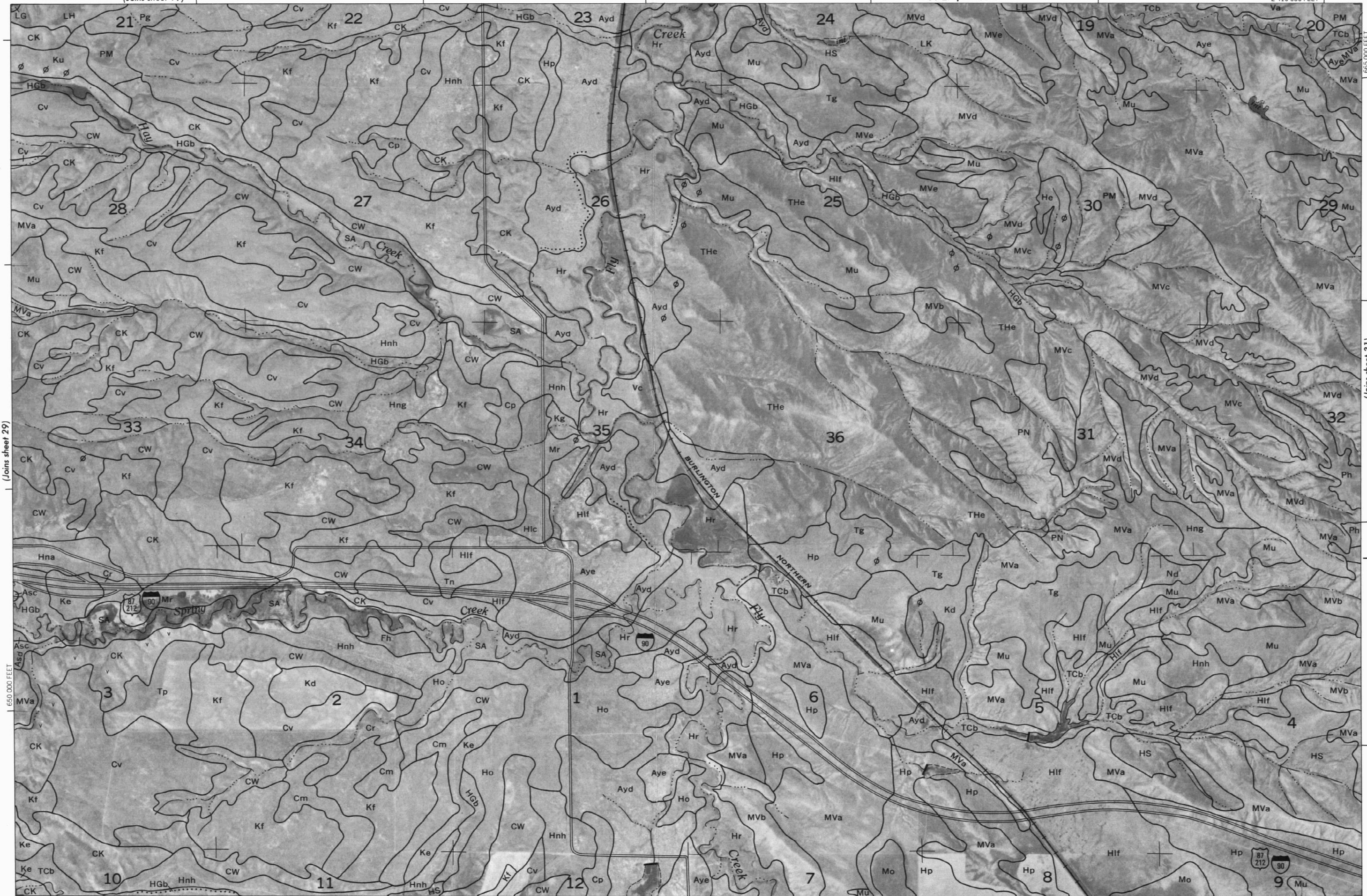






Scale 1:24 000

(Joins sheet 29)



(Joins sheet 41)

2 385 000 FEET

R. 30 E. | R. 31 E.

(Joins sheet 31)

T. 1 S. | T. 1 N.

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.  
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BIG HORN COUNTY AREA, MONTANA NO. 30

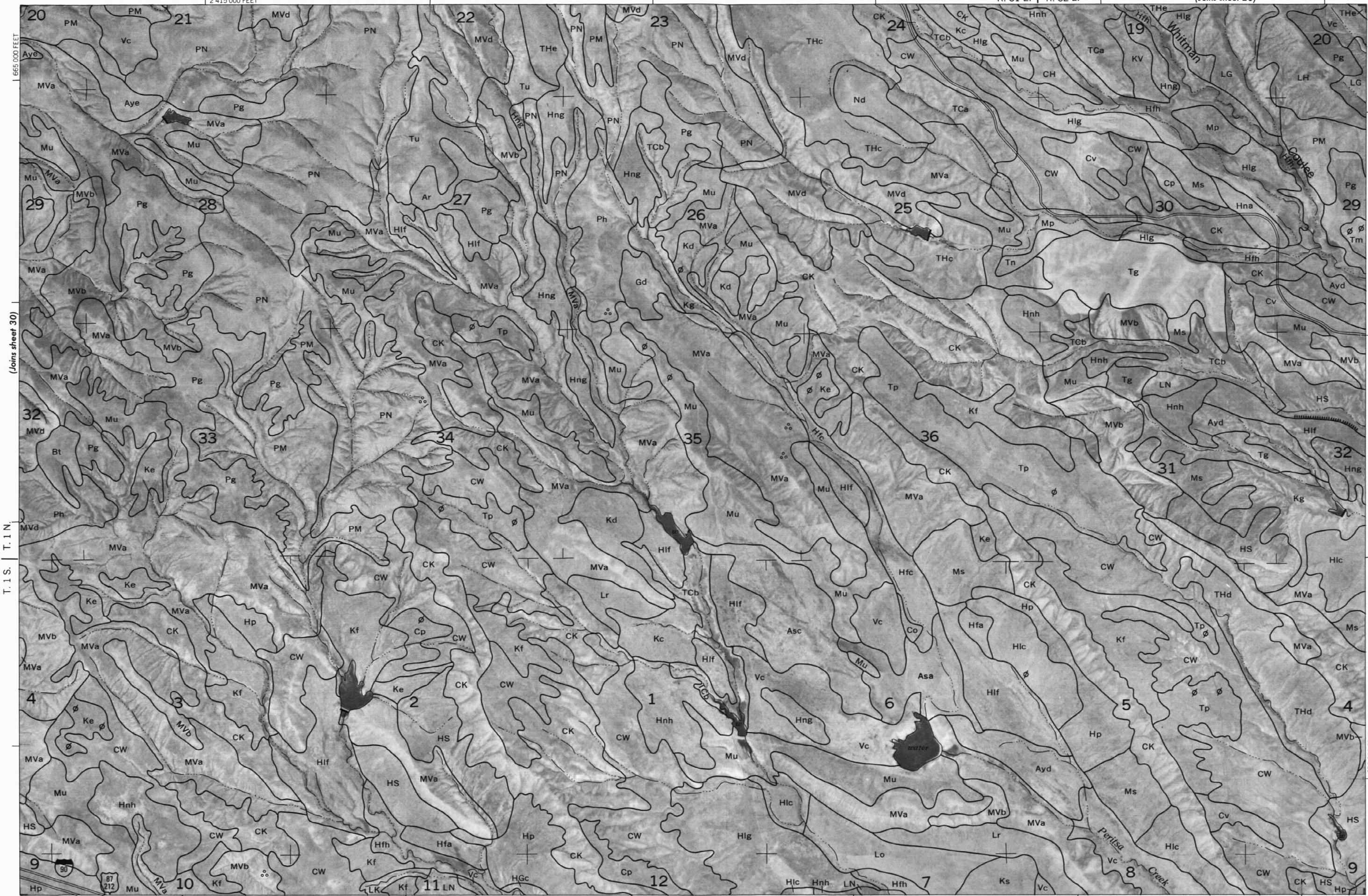




BIG HORN COUNTY AREA, MONTANA NO. 31

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

Coordinate grid ticks and land division corners, if shown, are approximately positioned.









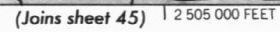
This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



(Joins sheet 44)

2 500 000 FEET









2 Miles  
10000 Feet

1  
5000

Scale 1:24,000

0 0 1000 2000 3000 4000 5000  
1/4 1/2 3/4

11

12

7

8

6

1

2

3

4

5

36

35

34

33

32

31

25

26

27

28

29

30

24

23

22

21

20

19

2 535 000 FEET

1 565 000 FEET

(Joins sheet 34)

T. 1 S. | T. 1 N.

PN

8

9

10

11

12

7

8

6

1

2

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4

5

36

35

34

33

32

31

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26

27

28

29

30

24

23

22

21

20

19

2 535 000 FEET

1 565 000 FEET

(Joins sheet 34)

T. 1 S. | T. 1 N.

PN

8

9

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11

12

7

8

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1

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4

5

36

35

34

33

32

31

25

26

27

28

29

30

24

23

22

21

20

19

2 535 000 FEET

1 565 000 FEET

(Joins sheet 34)

T. 1 S. | T. 1 N.

PN

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9

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11

12

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36

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32

31

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26

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24

23

22

21

20

19

2 535 000 FEET

1 565 000 FEET

(Joins sheet 34)

T. 1 S. | T. 1 N.

PN

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12

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24

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22

21

20

19

2 535 000 FEET

1 565 000 FEET

(Joins sheet 34)

T. 1 S. | T. 1 N.

PN

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12

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20

19

2 535 000 FEET

1 565 000 FEET

(Joins sheet 34)

T. 1 S. | T. 1 N.

PN

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24

23

22

21

20

19

2 535 000 FEET

1 565 000 FEET

(Joins sheet 34)

T. 1 S. | T. 1 N.

PN

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11

12

7

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6

1

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5

36

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26

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28

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30

24

23

22

21

20

19

2 535 000 FEET

1 565 000 FEET

(Joins sheet 34)

T. 1 S. | T. 1 N.

PN

8

9

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11

12

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8

6

1

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24

23

22

21

20

19

2 535 000 FEET

1 565 000 FEET

(Joins sheet 34)

T. 1 S. | T. 1 N.

PN

8

9

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12

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1

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31

25





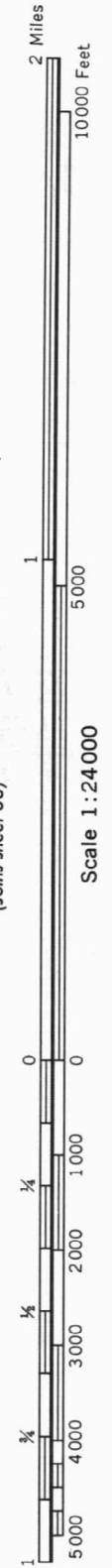
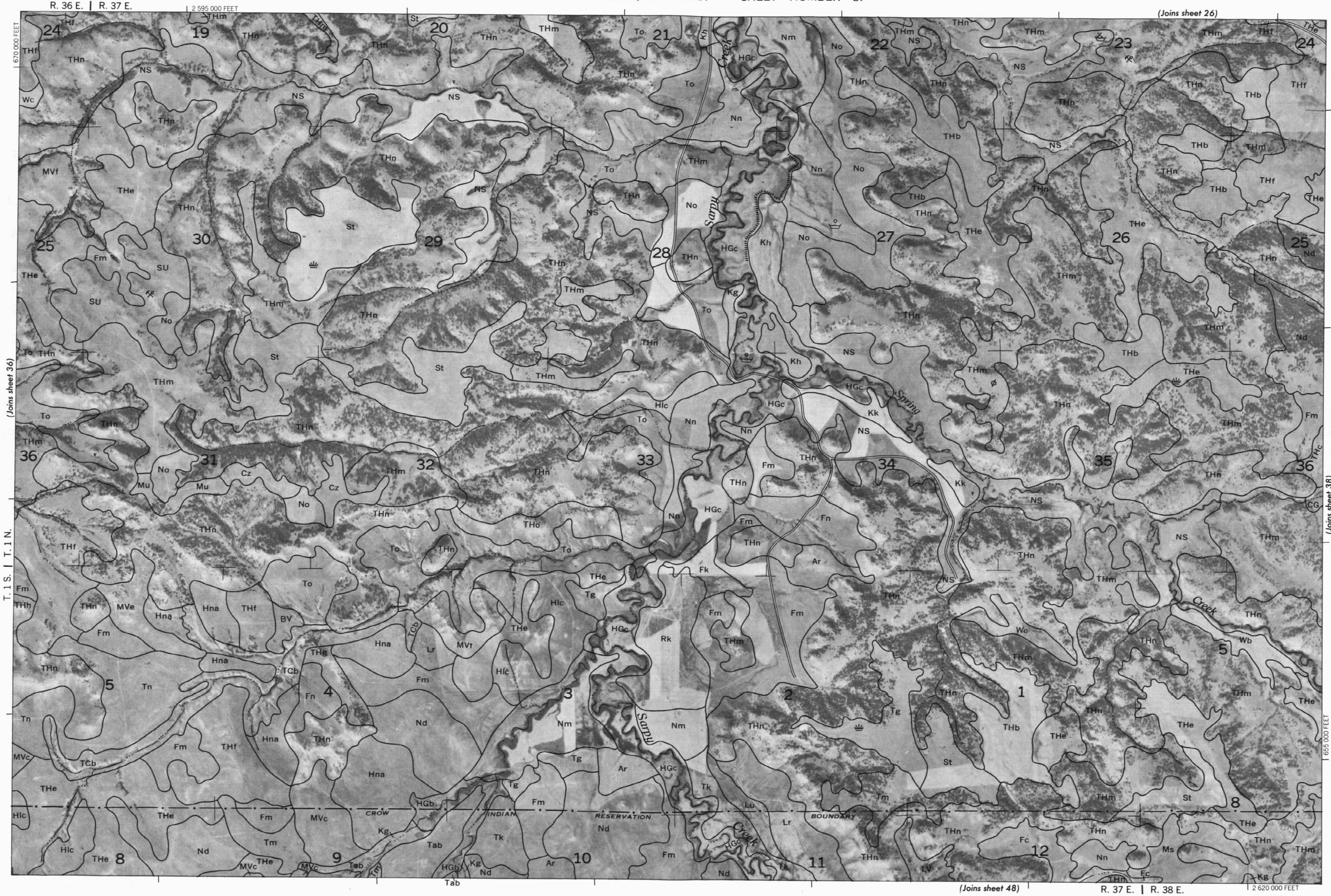
This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BIG HORN COUNTY AREA, MONTANA NO. 36



BIG HORN COUNTY AREA, MONTANA NO. 37  
This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.  
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



(Joins sheet 26)

(Joins sheet 36)

(Joins sheet 38)

(Joins sheet 48)

R. 36 E. | R. 37 E.

2 595 000 FEET

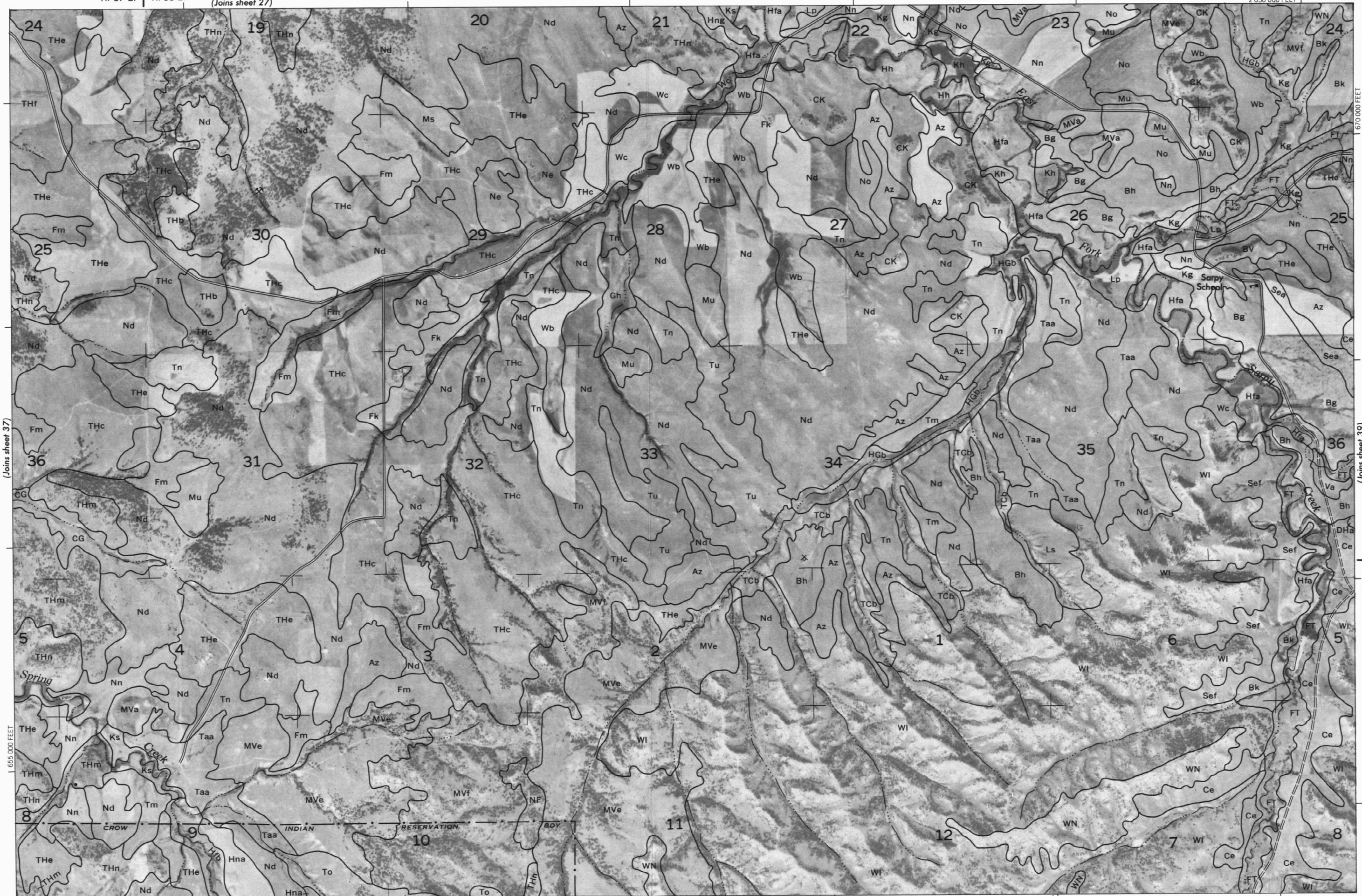
R. 37 E. | R. 38 E.

2 620 000 FEET





Scale 1:24000  
(Joins sheet 37)

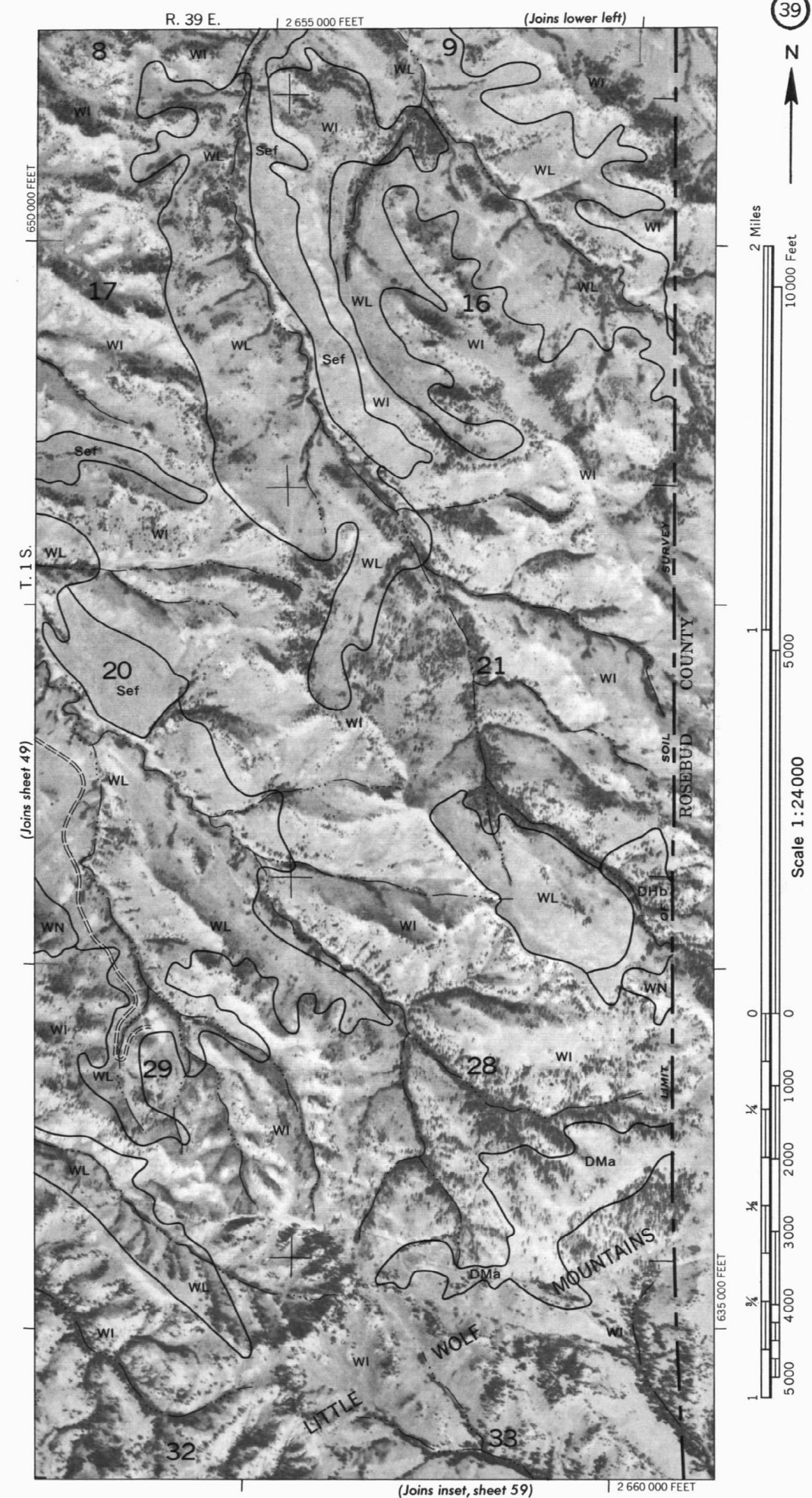
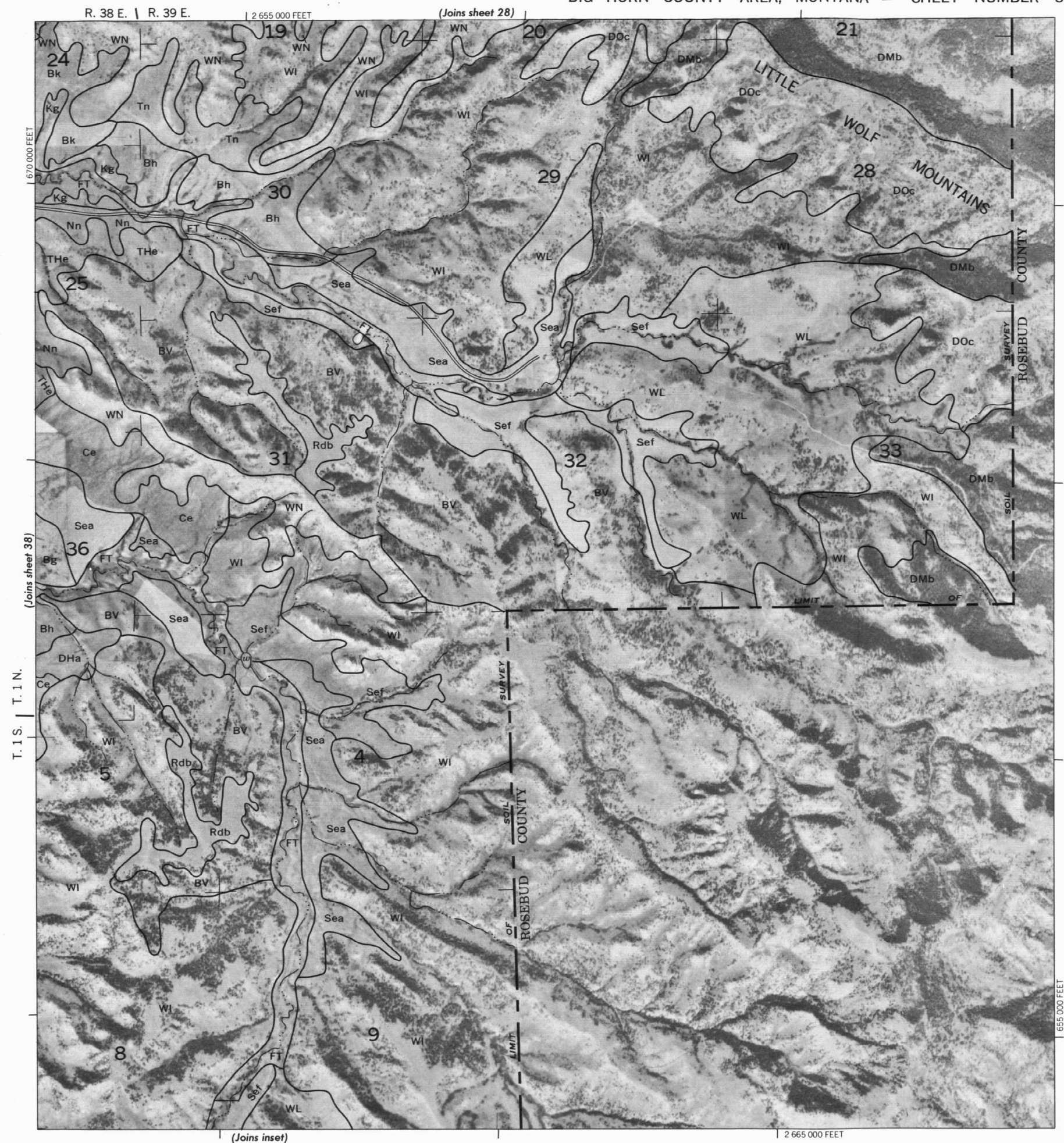


2 625 000 FEET (Joins sheet 49)

T. 1 S. | T. 1 N. (Joins sheet 39)



This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.





Scale 1:24000

1 630 000 FEET

2 355 000 FEET

(Joins sheet 50)

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BIG HORN COUNTY AREA, MONTANA NO. 40







2 440 000 FEET



1111

1041

1111

1111

1  
5000

3

1.24

5

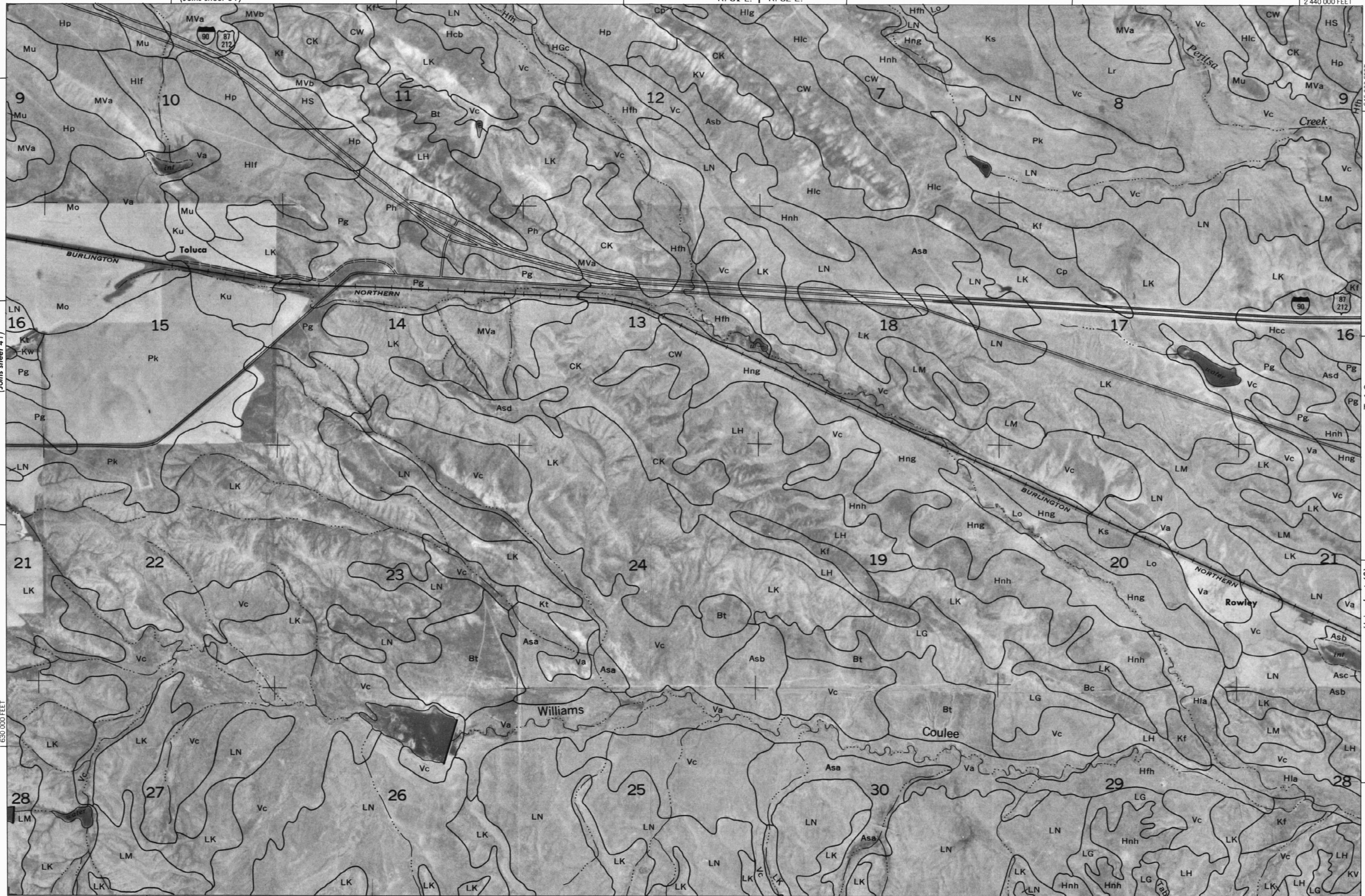
1 000

2000	$\frac{1}{2}$
------	---------------

3000

4000  
 $\frac{3}{4}$

1 5000



2 415 000 FEET (Joins sheet 52)

(Joins sheet 43) T. 1 S.

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BIG HORN COUNTY AREA, MONTANA NO. 42



10 000 Feet

1000

5000
------

Scale 1:24000

1000	0
------	---

000	2000
-----	------

4000	3
------	---

5 000

(Joins sheet 53)

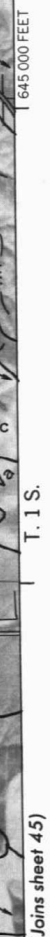
2 470 000 FEET

BIG HORN COUNTY AREA, MONTANA NO. 43

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



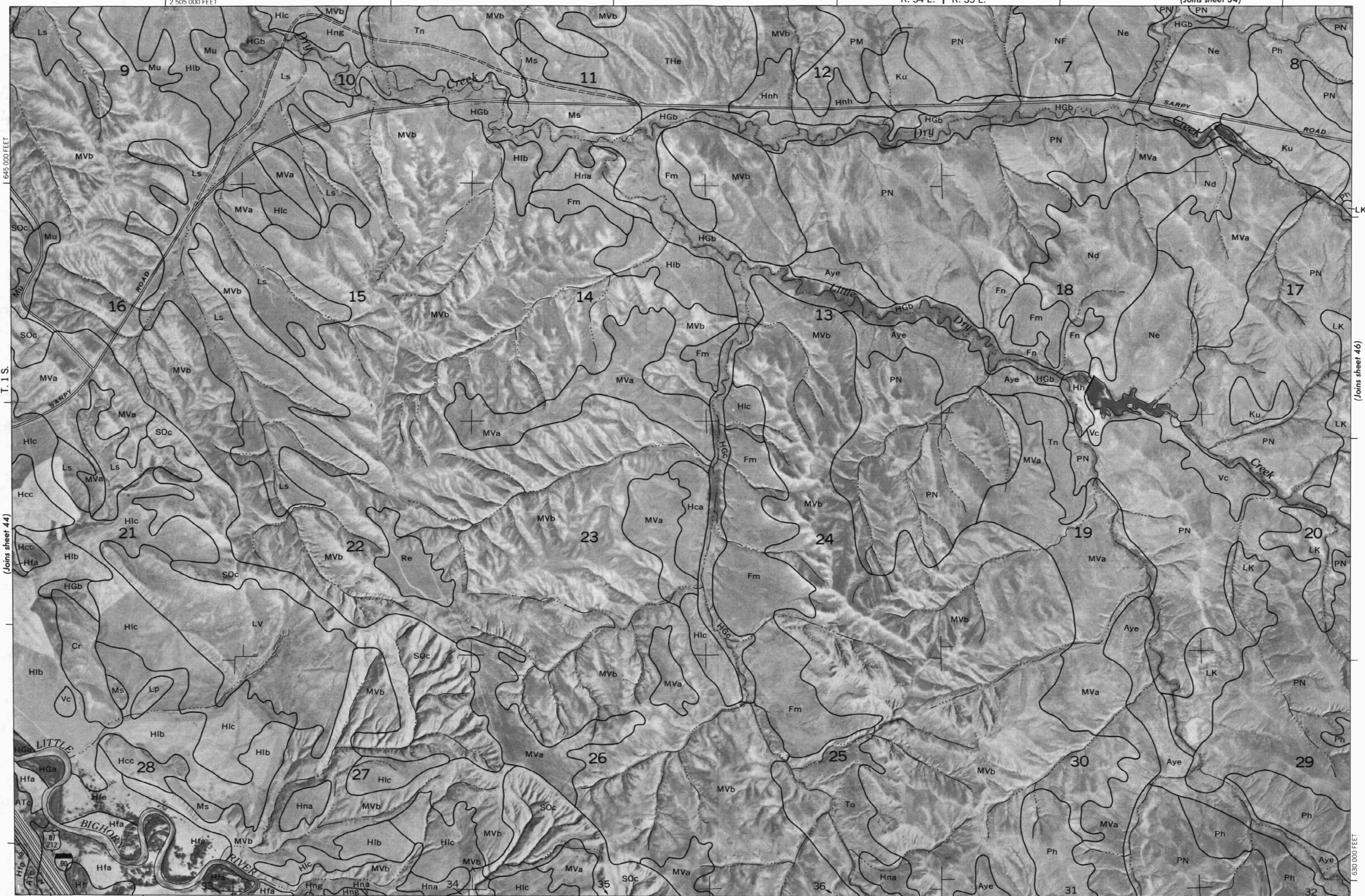




This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BIG HORN COUNTY AREA, MONTANA NO. 44



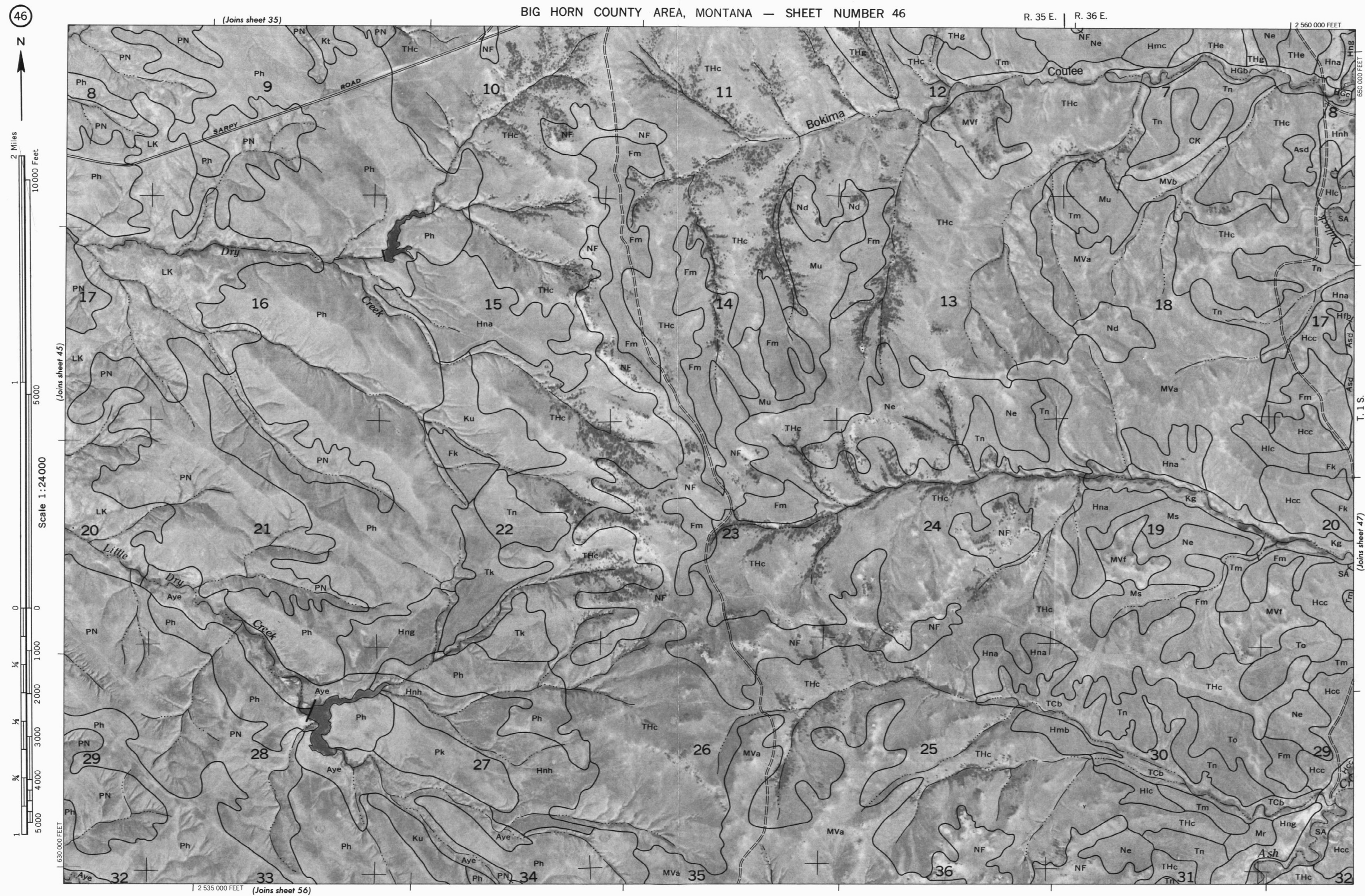




T. 1 S.

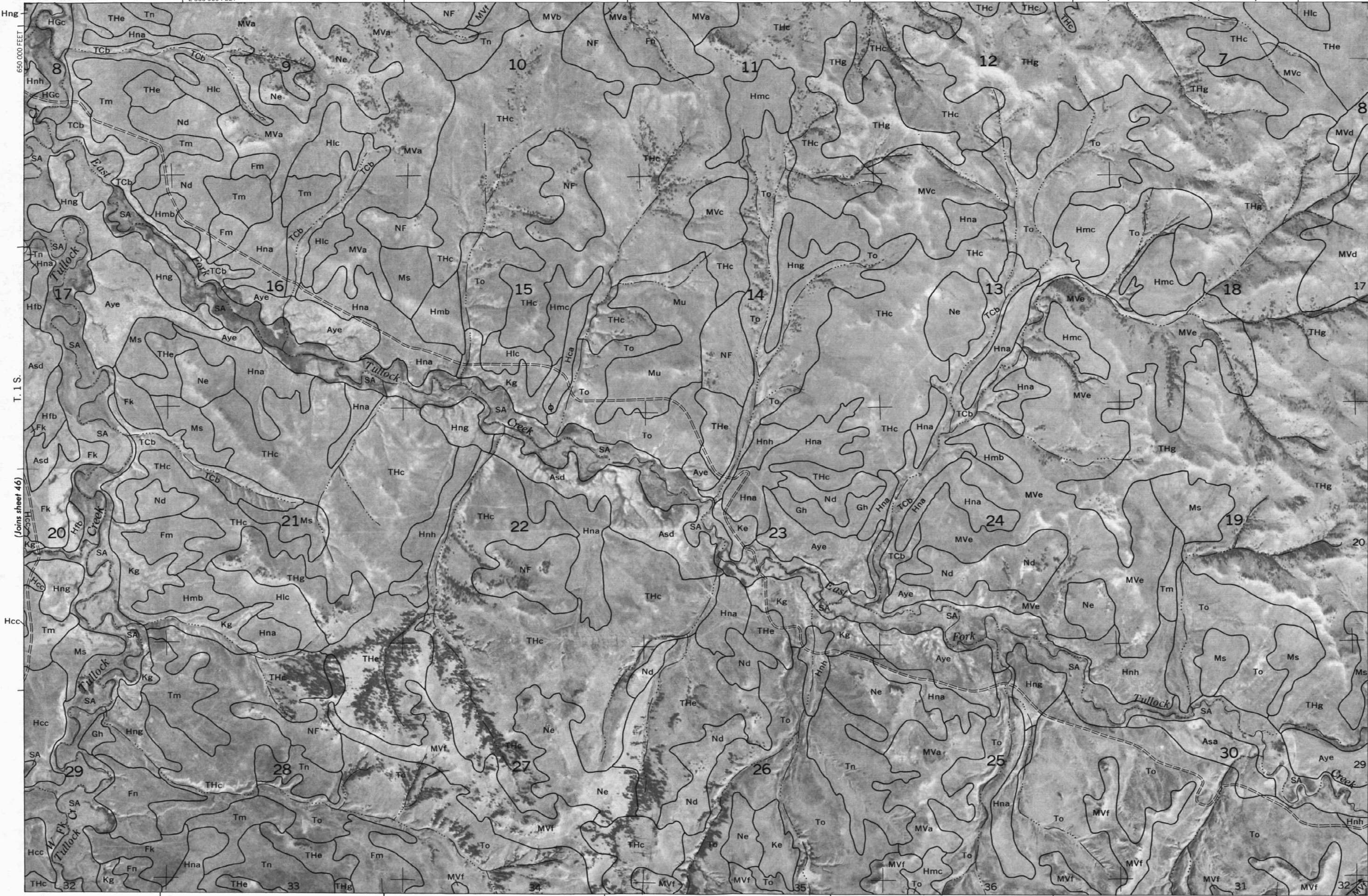
This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BIG HORN COUNTY AREA, MONTANA NO. 46





2 565 000 FEET



(Joins sheet 48)



Scale 1:24,000

(Joins sheet 57)

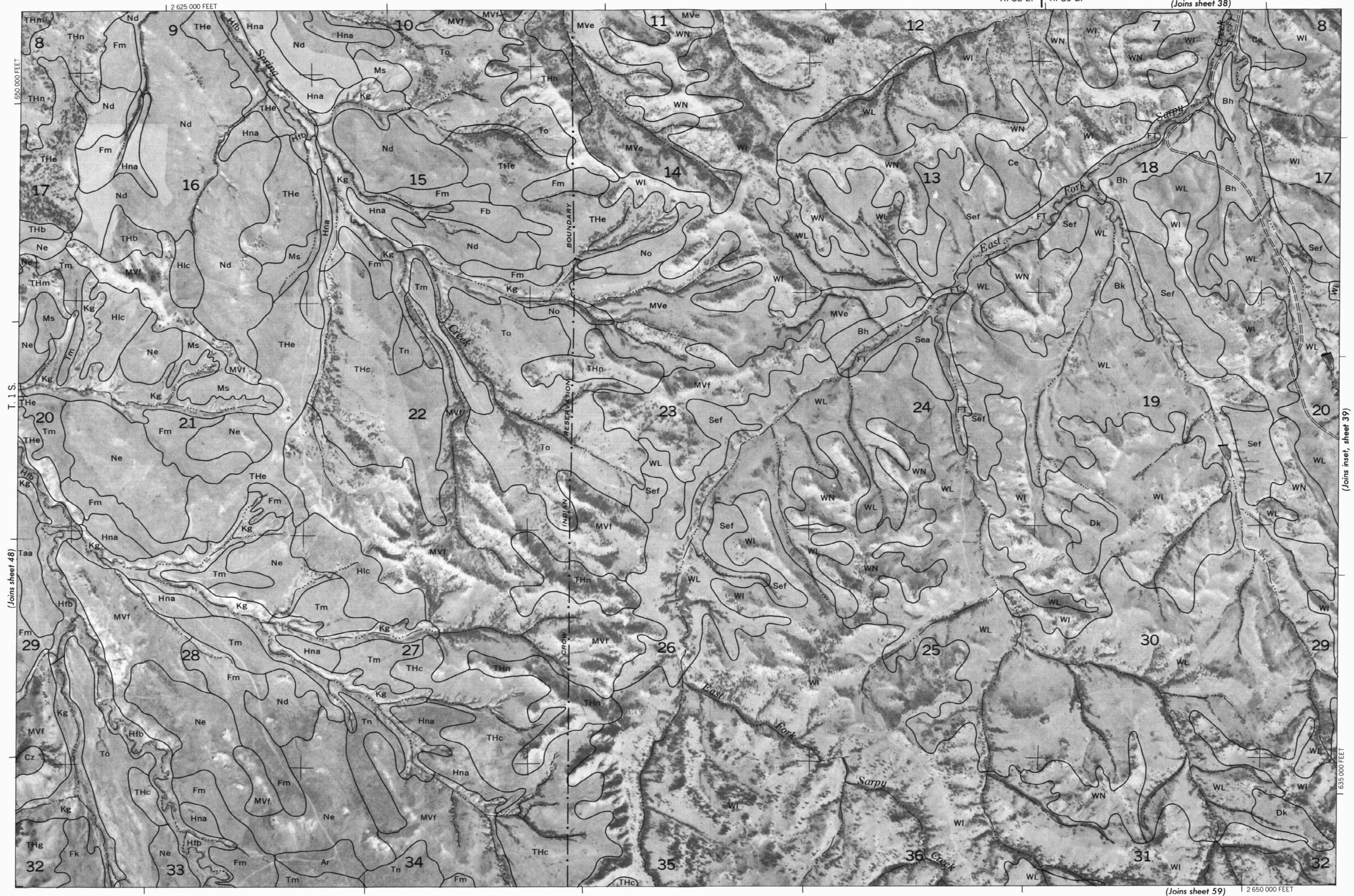
2 590 000 FEET







This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



10 000 Feet

Scale 1:24000



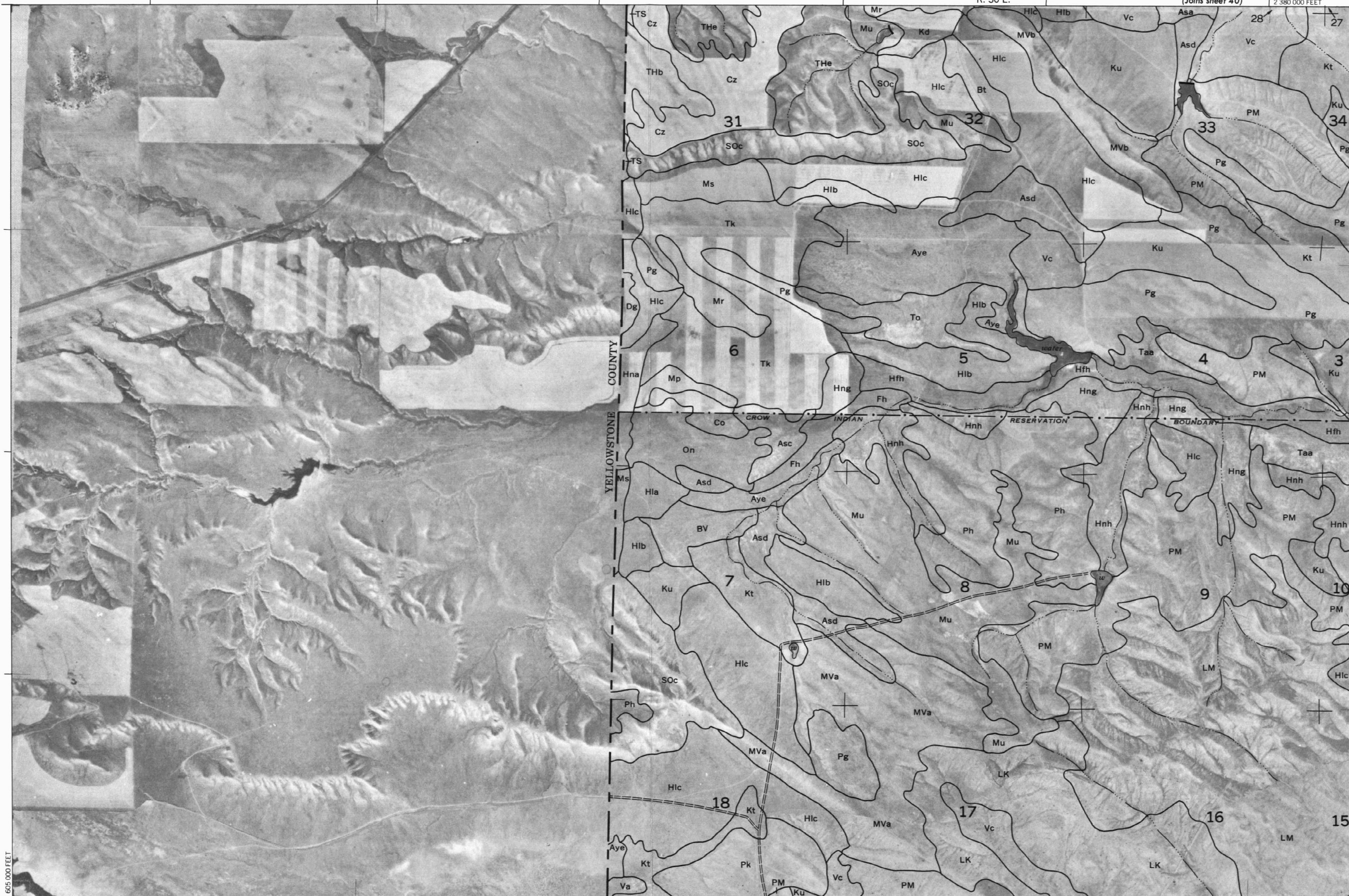


2 Miles  
10000 Feet

1  
5000

Scale 1:24000

0 0 1000 2000 3000 4000 5000  
1/4 1/2 3/4



605 000 FEET

2 355 000 FEET

(Joins sheet 60)

T. 2 S. | T. 1 S.

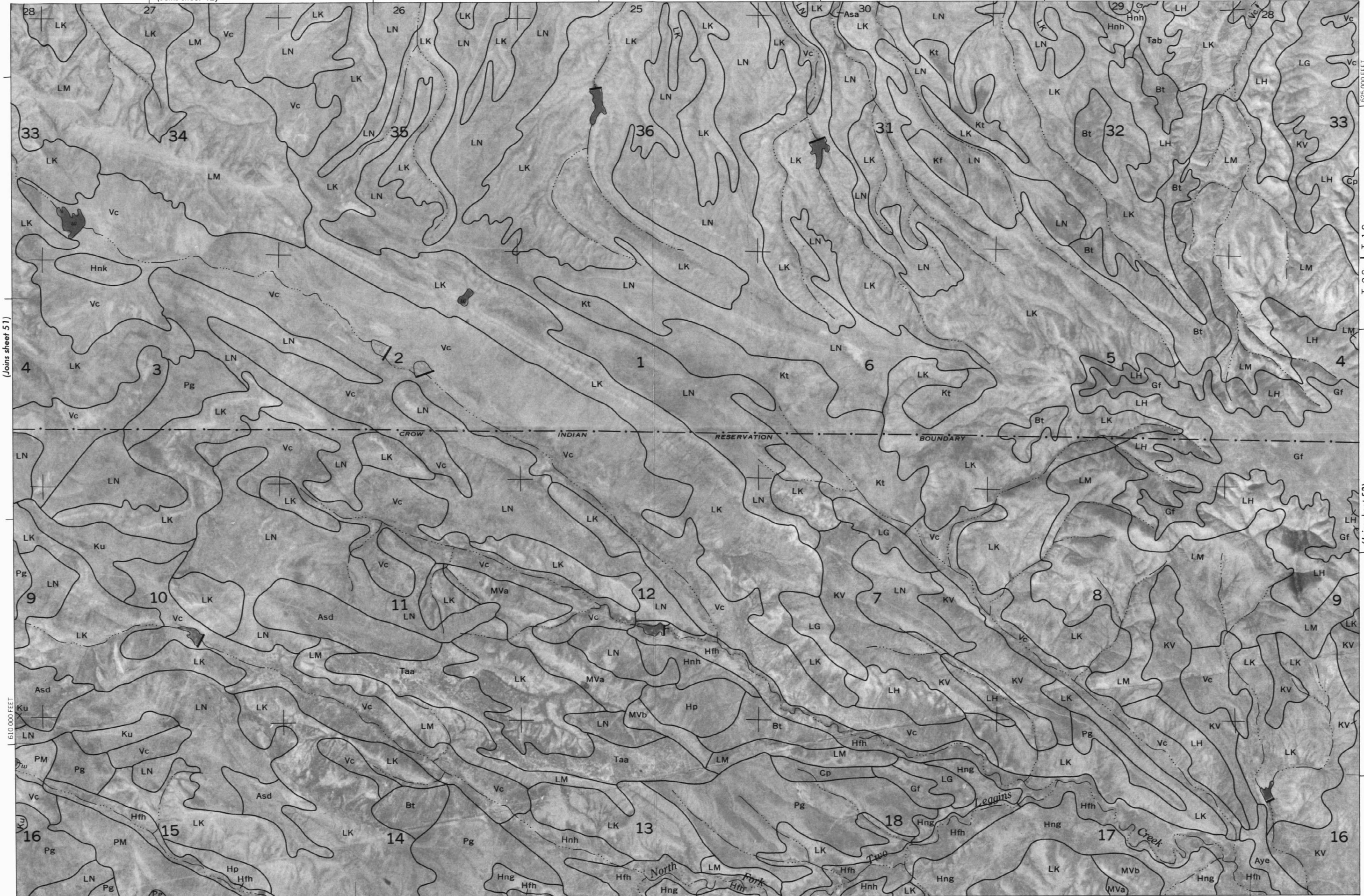
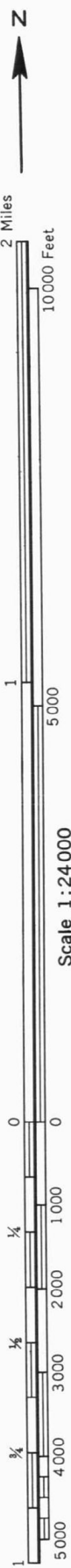
(Joins sheet 51)







(Joins sheet 42)

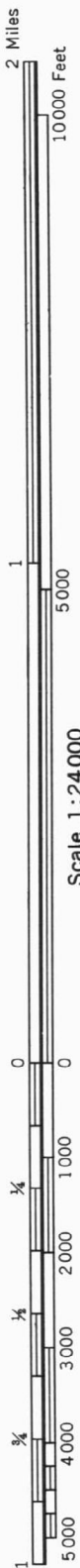


(Joins sheet 62)







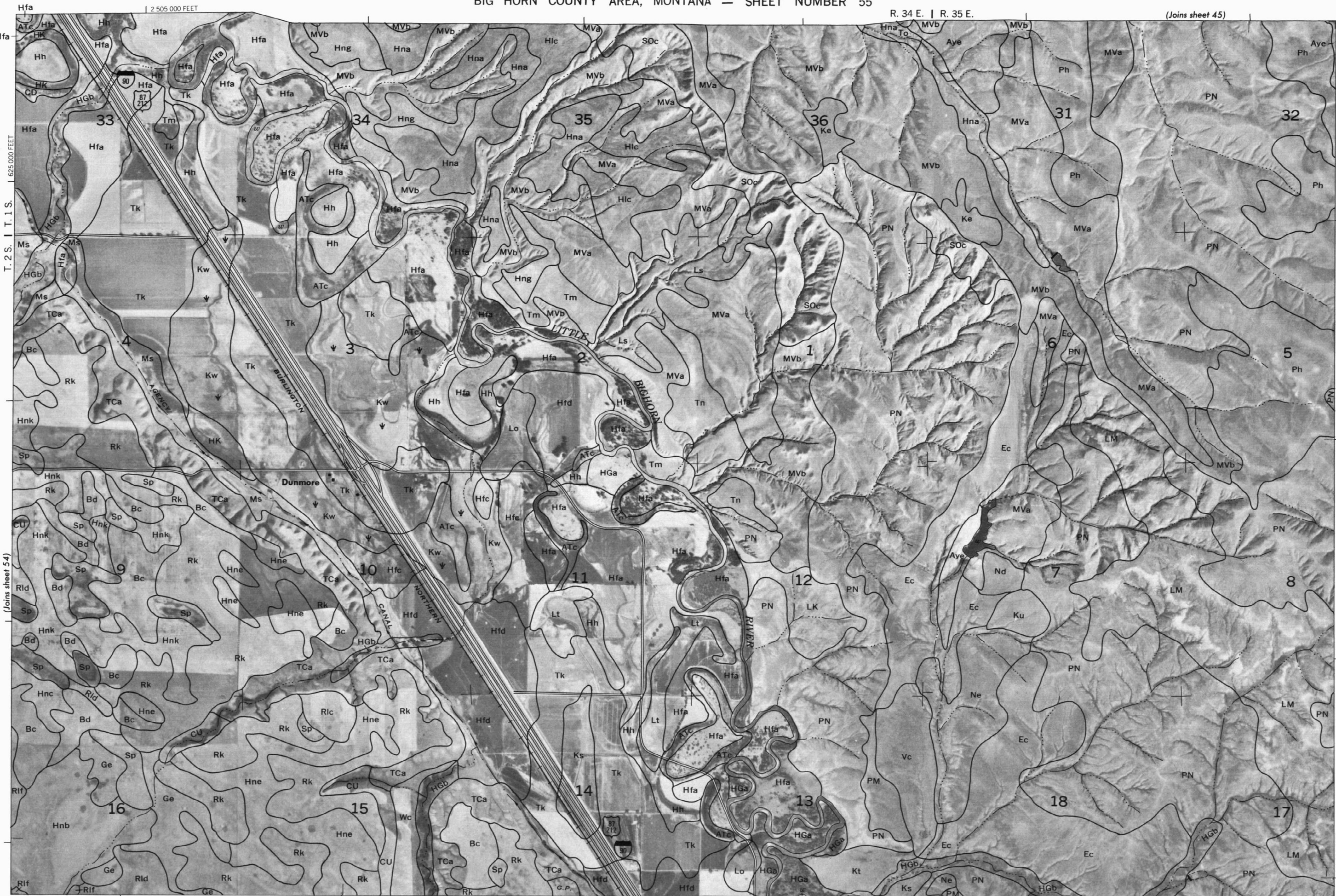


BIG HORN COUNTY AREA, MONTANA NO. 54





Scale 1:24000







2 Miles

10000 Feet

1

5000

Scale 1:24000

0

0

1000

2000

3000

4000

5000

1/4

1/2

3/4

1

1/4

1/2

3/4

1

1/4

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1/4

1/2

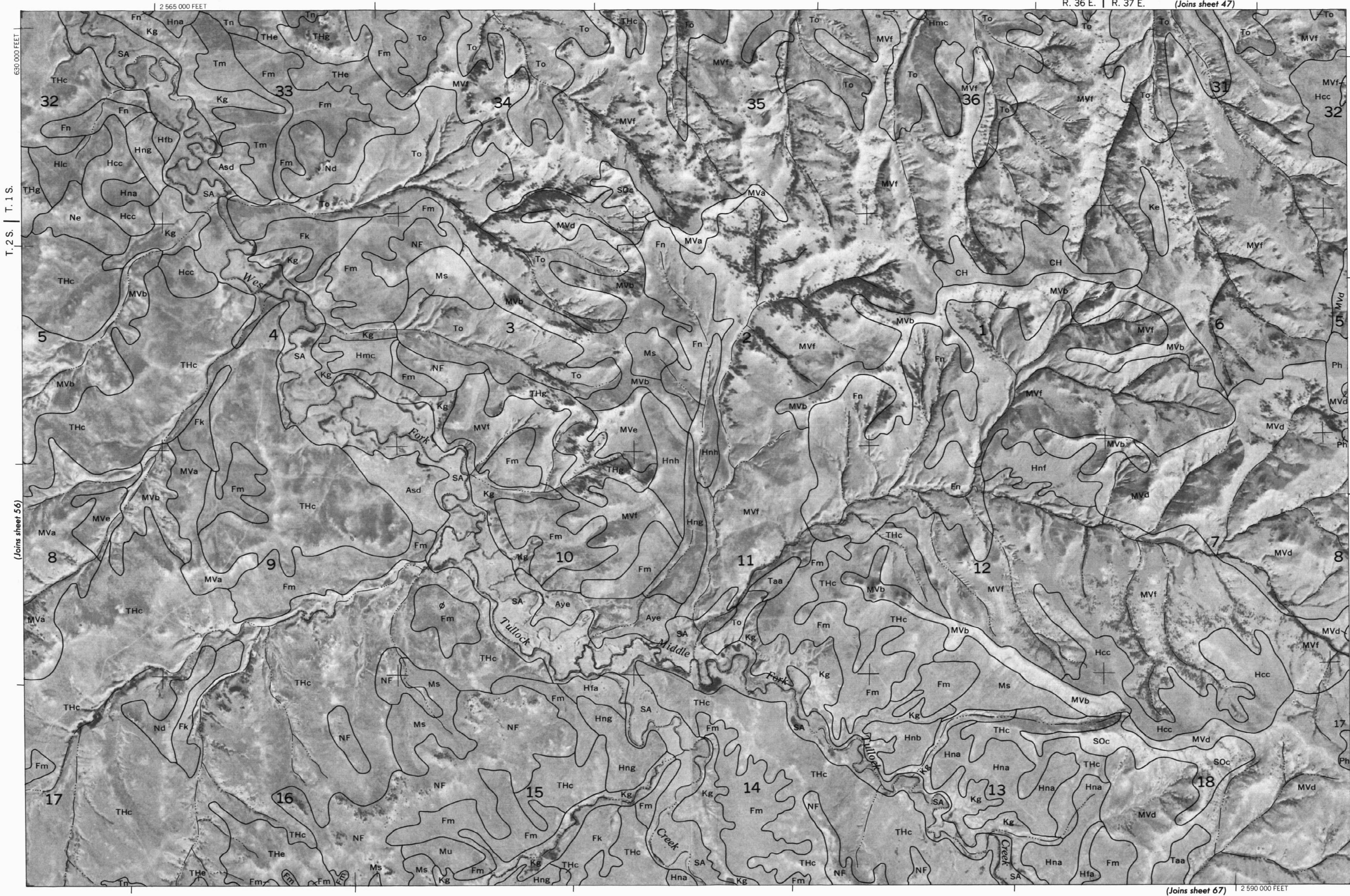
3/4

1

1/4



This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.





(Joins sheet 48)

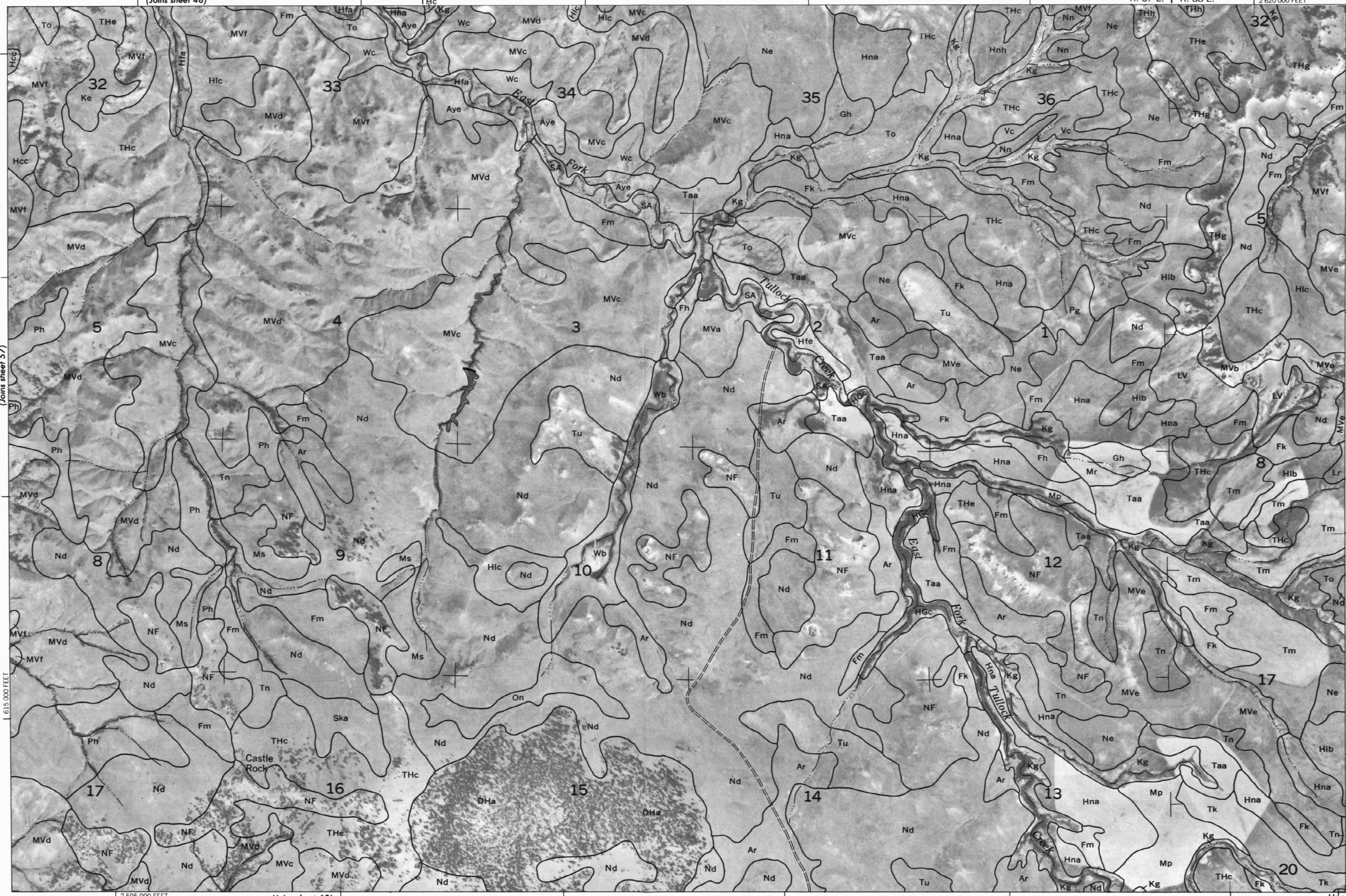


2 Miles  
10000 Feet

1  
5000

Scale 1:24000

0 0 1000 2000 3000 4000 5000  
1/4 1/2 3/4  
615 000 FEET



2 595 000 FEET

(Joins sheet 68)

(Joins sheet 59)

T. 2 S. | T. 1 S.

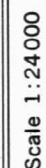
630 000 FEET

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.  
Coordinate grid ticks and land division corners, if shown, are approximately positioned.









2 355 000 FEET

(Joins sheet 69)

T. 3 S. | T. 2 S.

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



Scale 1:24000

2 410 000 FEET

T.3S. | T.2S.

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.





This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.



This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.  
Coordinate grid ticks and land division corners, if shown, are approximately positioned.







2 Miles  
10 000 Feet

1  
5 000

Scale 1:24 000

0 0 1 000 2 000 3 000 4 000 5 000  
500 000 FEET





Scale 1:24 000

2 Miles

10000 Feet

1/4 1/2 3/4 1

0 1000 2000 3000 4000 5000

(Joins sheet 74)

2 530 000 FEET





2 Miles  
10000 Feet

1  
5000

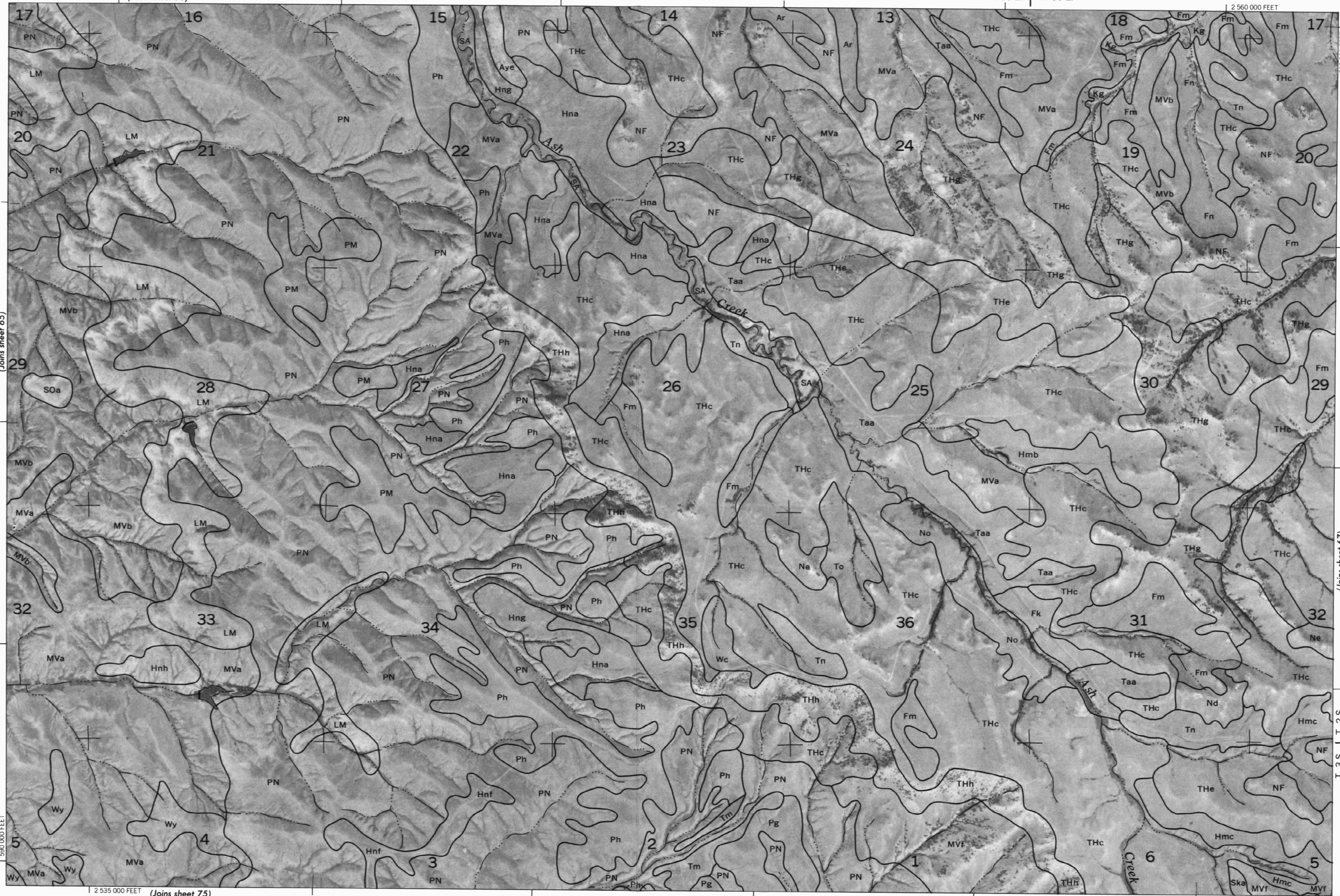
Scale 1:24000

0 0 1000 2000 3000 4000 5000  
1/4 1/2 3/4

590 000 FEET

(Joins sheet 56)

2 560 000 FEET



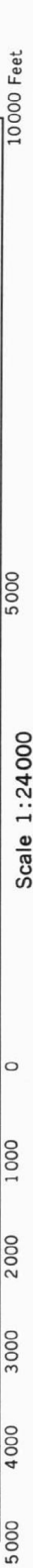
(Joins sheet 67)

T. 3. S. | T. 2. S.

2 535 000 FEET (Joins sheet 75)



R. 36 E. | R. 37 E. (Joins sheet 57)



This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.





2 Miles  
10 000 Feet

1  
5 000

Scale 1:24 000

0 0  
1 000  
2 000  
3 000  
4 000  
5 000

(Joins sheet 67)

595 000 FEET

2 595 000 FEET (Joins sheet 77)

610 000 FEET

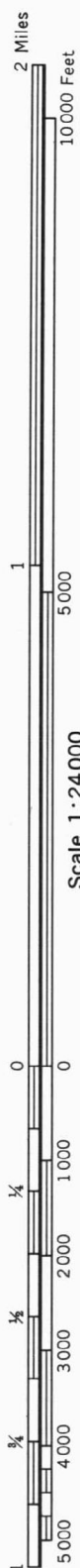
(Joins inset, sheet 78)

T. 3 S. | T. 2 S.

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



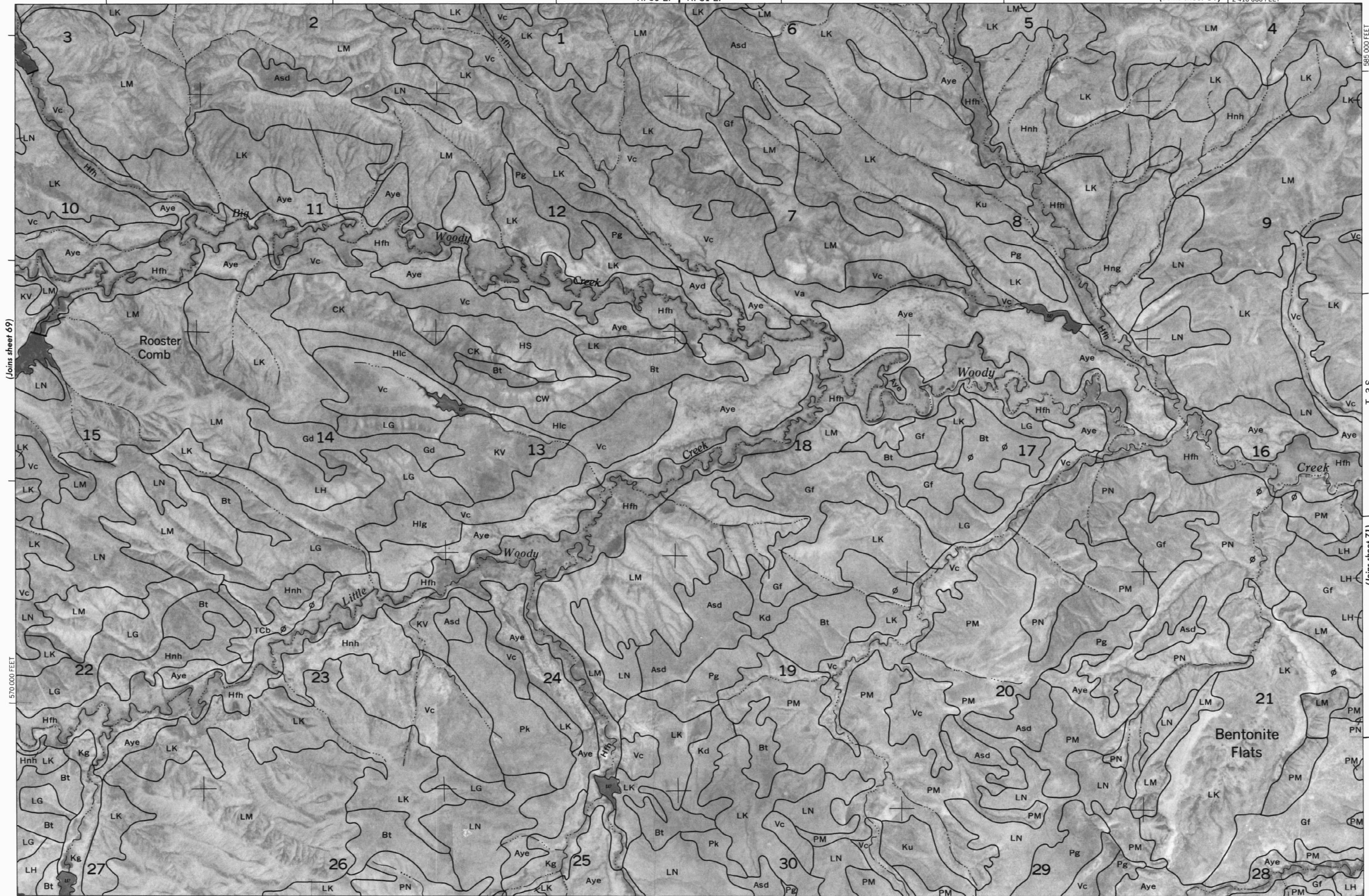
(Joins sheet 60)



2 380 000 FEET

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.





This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.  
Coordinate grid ticks and land division corners, if shown, are approximately positioned.





Scale 1:24 000

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.





2 Miles  
10 000 Feet

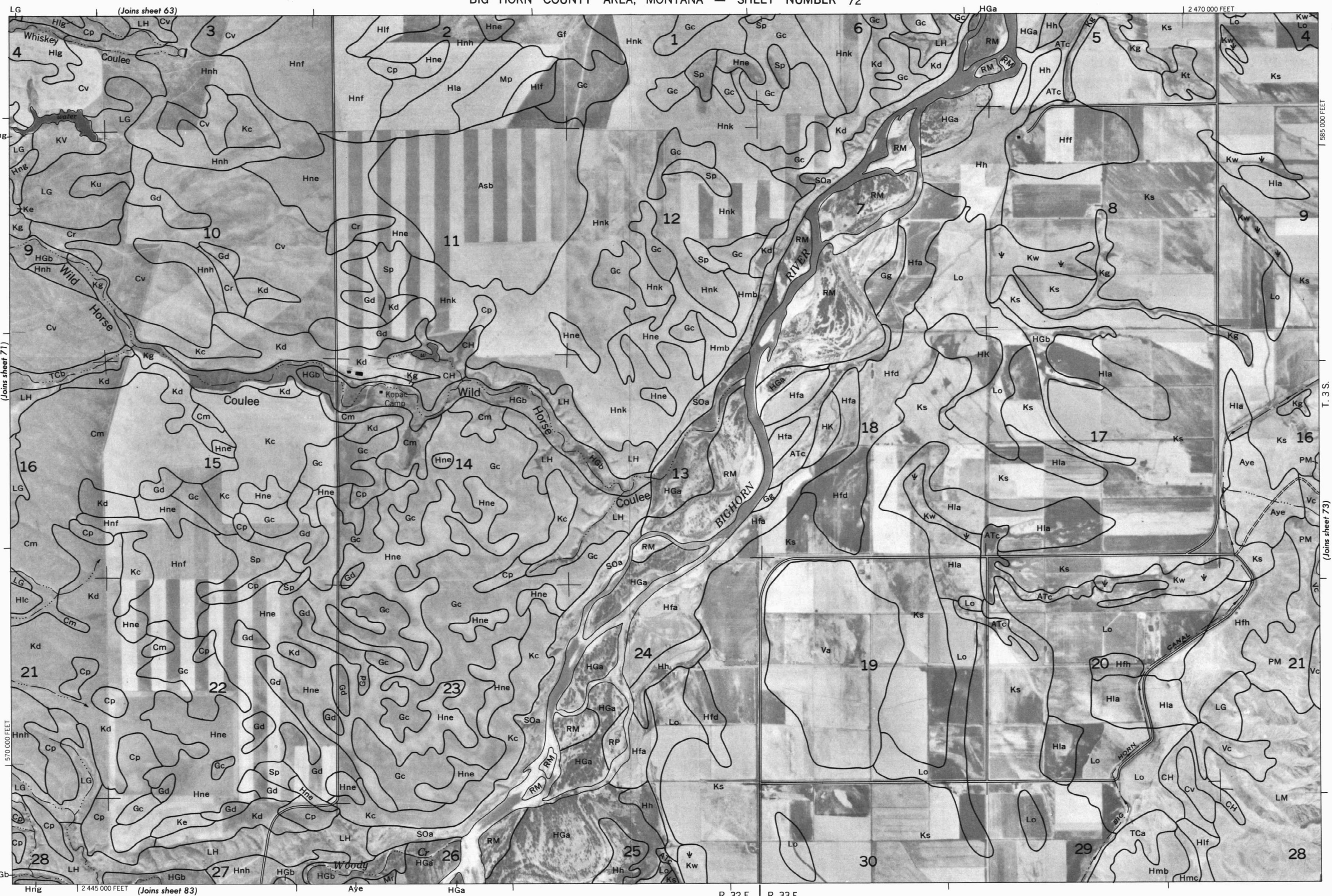
1  
5 000

Scale 1:24 000

0 0  
1 000  
2 000  
3 000  
4 000  
5 000

1/4  
1/2  
3/4

1



(Joins sheet 63)

2 470 000 FEET

2 445 000 FEET (Joins sheet 83)

R. 32 E. | R. 33 E.

585 000 FEET

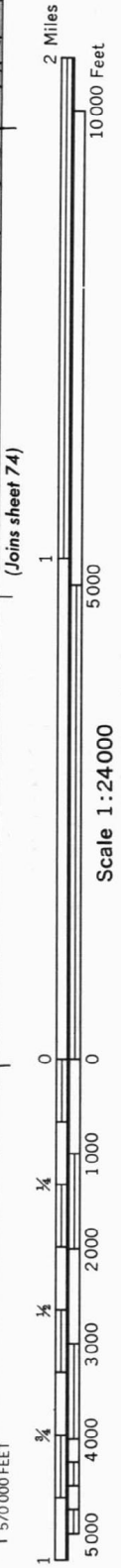
T. 3 S.

(Joins sheet 73)

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



70 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



(Joins sheet 84) | 2 500 000 FEET

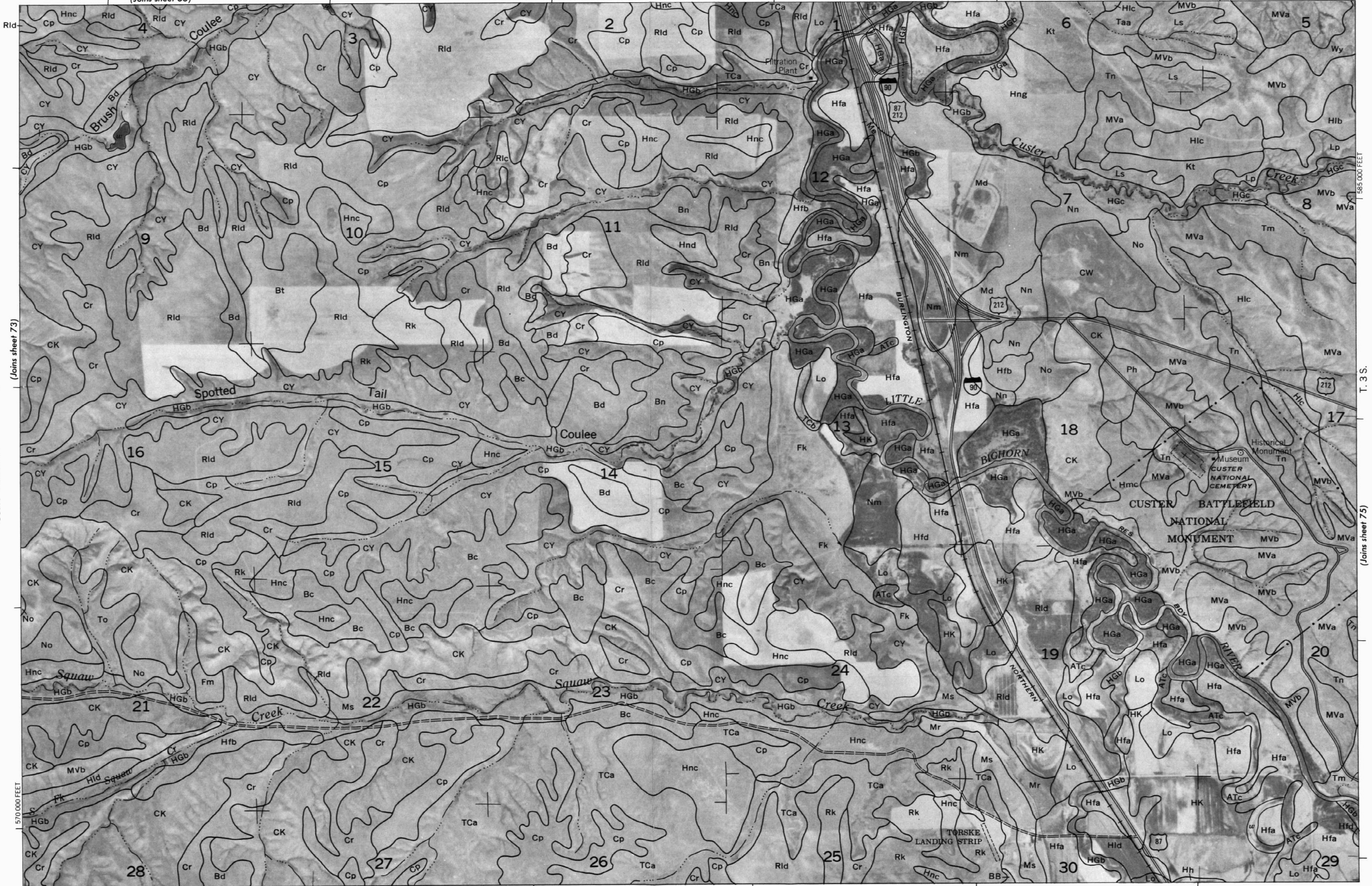




(Joins sheet 73)

Scale 1:24,000

2 505 000 FEET (Joins sheet 85)



T. 3 S.

(Joins sheet 75)

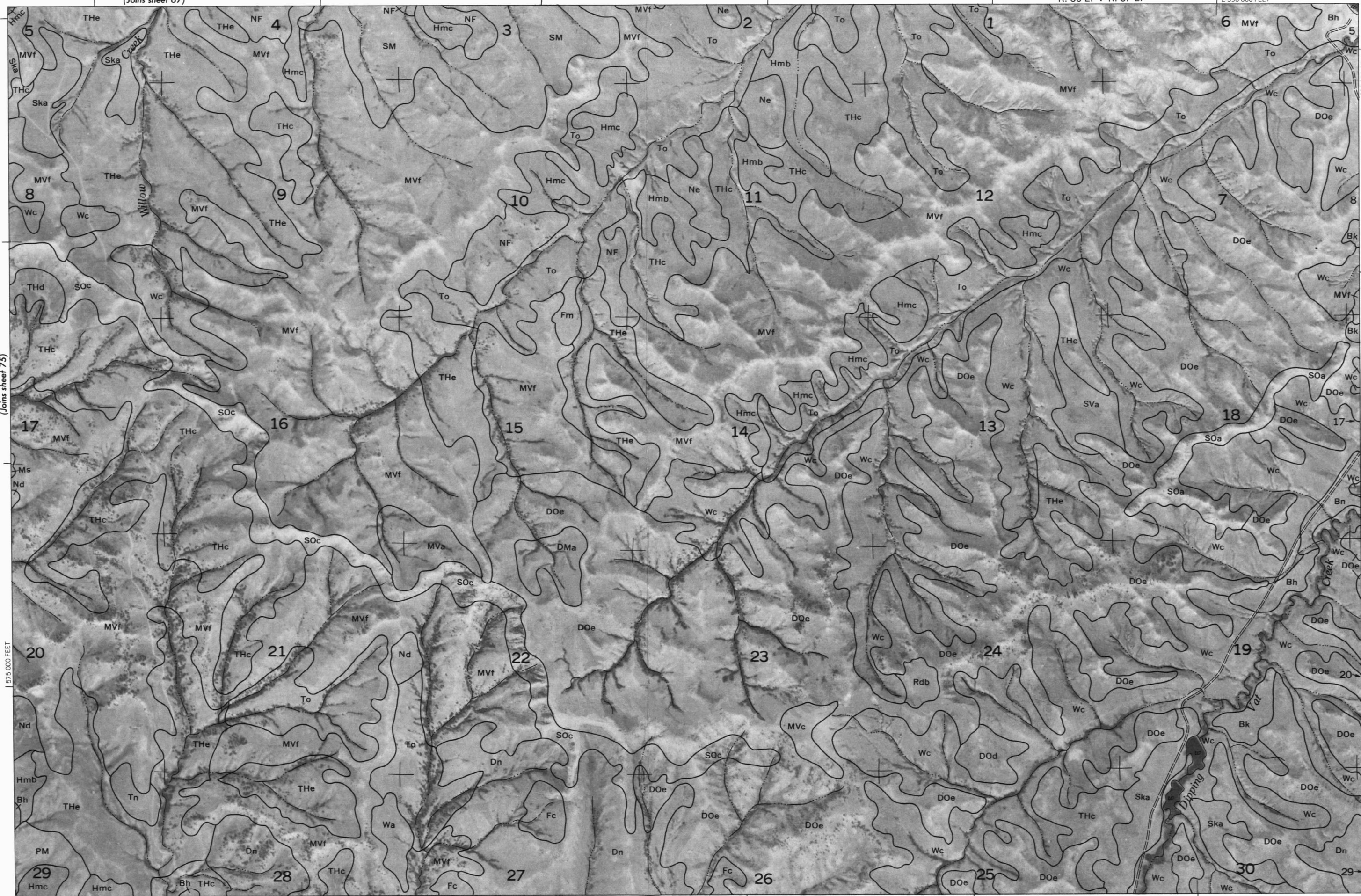


[illegible]



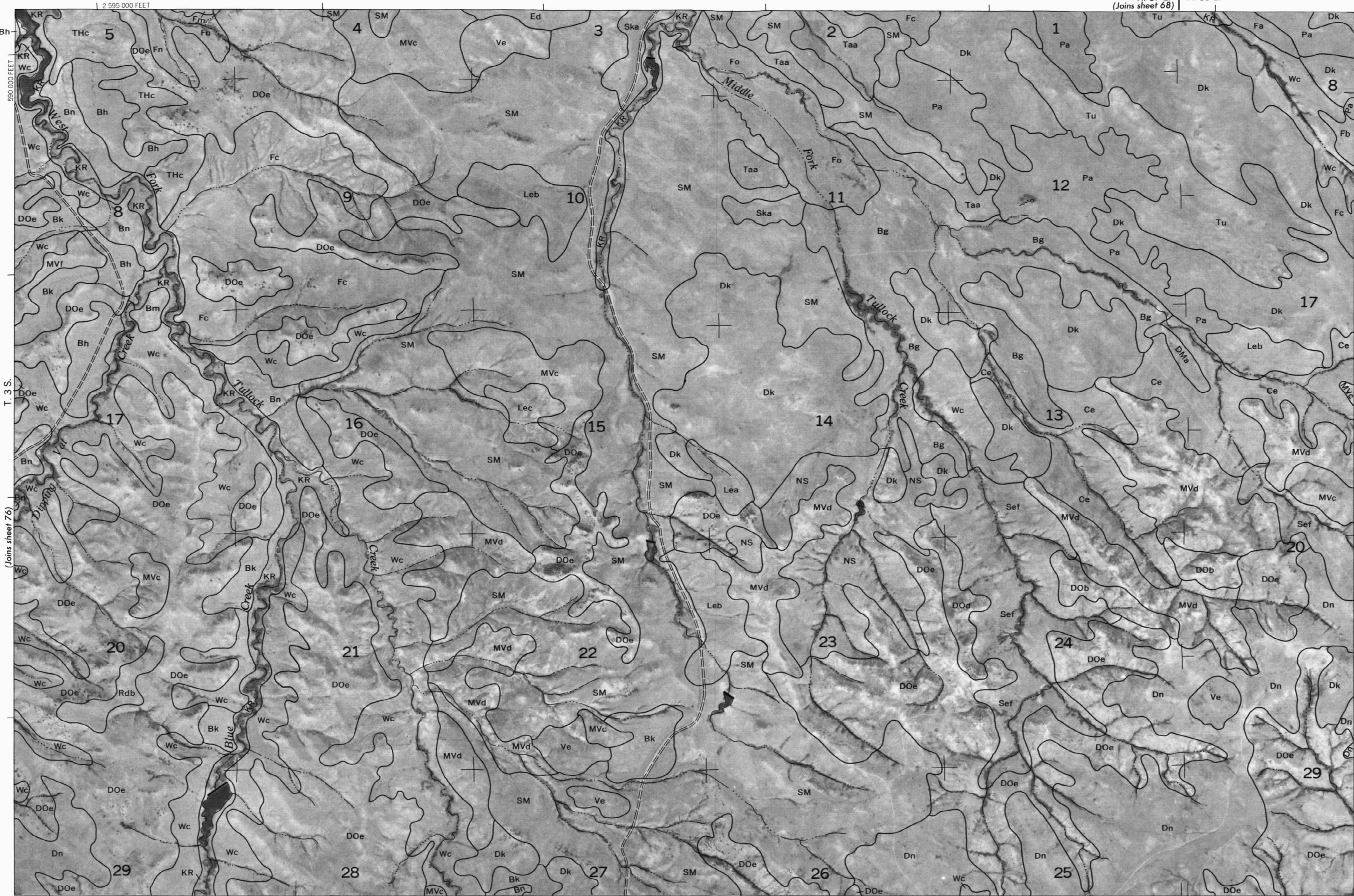
(Joins sheet 77)

(Joins sheet 77)



This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.





This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.





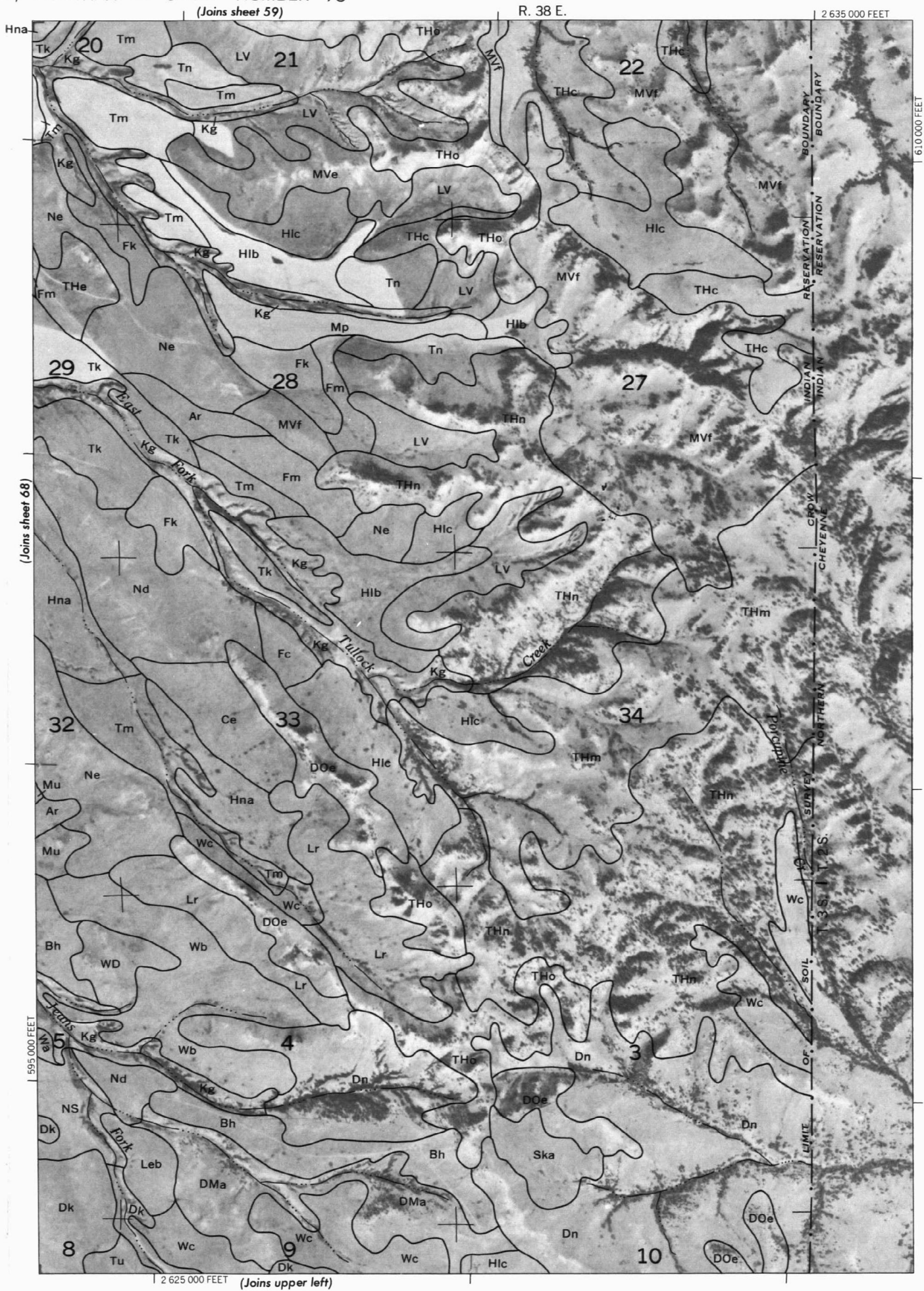


2 Miles  
10 000 Feet

1  
5 000

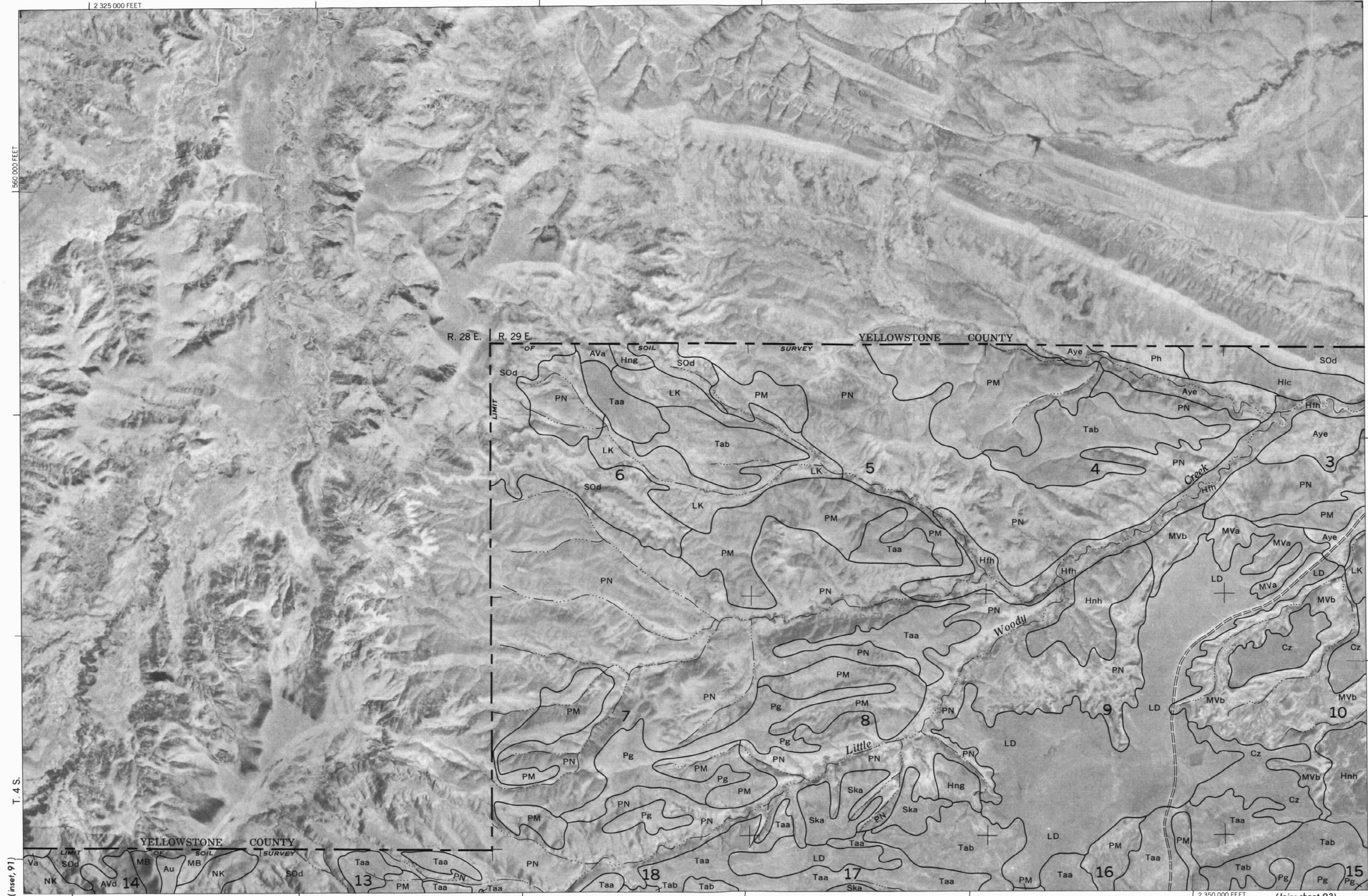
Scale 1:24 000

0 0 1 000 2 000 3 000 4 000 5 000  
1/4 1/2 3/4





This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



(inset, 91)

(Joins sheet 80)

(Joins sheet 93)





2 Miles

10 000 Feet

1

5000

Scale 1:24 000

(Joins sheet 79)

0

0

1/4

1000

1/4

2000

1/4

3000

1/4

4000

5000

YELLOWSTONE COUNTY  
SURVEY  
SOIL

LIMIT

OF

YELLOWSTONE COUNTY

WILD HORSE RIDGE

30

31

32

33

34

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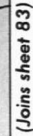


(Joins sheet 95) 2 410 000 FEET



This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.











R. 33 E. | R. 34 E

2 Miles

A diagram of a resistor with four color bands. The first band is brown, the second is black, the third is red, and the fourth (tolerance) band is gold. The text "2 M" is written vertically to the left of the resistor.

14

11

11

11

11

11

11

11

11

11

11

11

11

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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1000

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[illegible]

11

11

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4/

11

1

10

Scale 1:24 000

**(Joins sheet 83)**

1 550 000 FEET

2 475 000 FEET

(Joins sheet 98)

565 000 FEET

T. 4 S. | T. 3 S.

(Joins sheet 85)

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BIG HORN COUNTY AREA, MONTANA NO. 84







1:45. 1:35.

(Joins sheet 01)

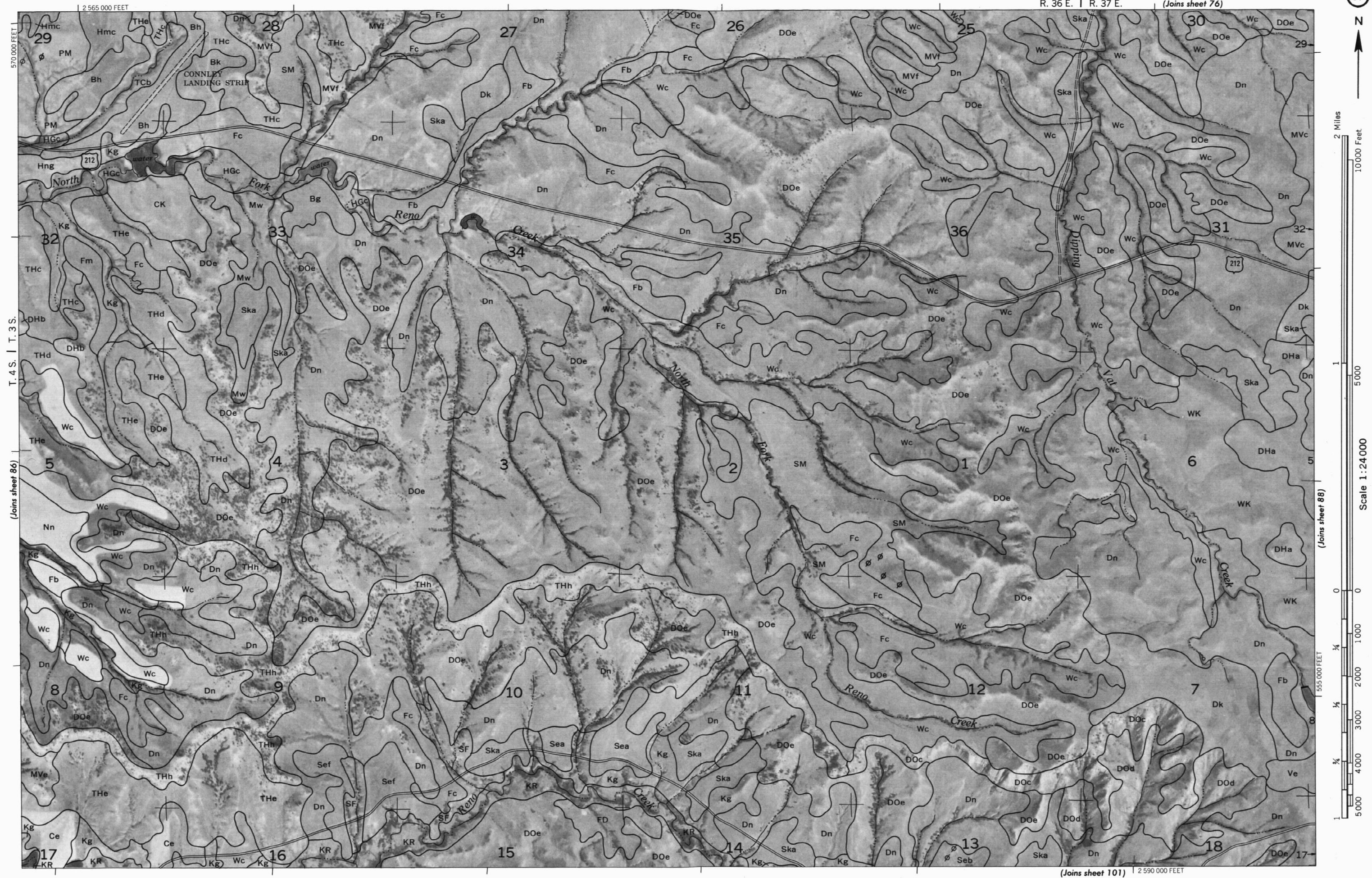
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BIG HORN COUNTY AREA, MONTANA. NO. 86



BIG HORN COUNTY AREA, MONTANA NO. 87





(Joins sheet 77)

2 620 000 FEET



2 Miles  
10 000 Feet

1

5000

Scale 1:24 000

0

0

1000

2000

3000

4000

5000

555 000 FEET

T. 4 S. | T. 3 S.

(Joins sheet 87)

555 000 FEET

2 595 000 FEET

(Joins sheet 102)

T. 4 S. | T. 3 S.

(Joins inset, sheet 103)

570 000 FEET

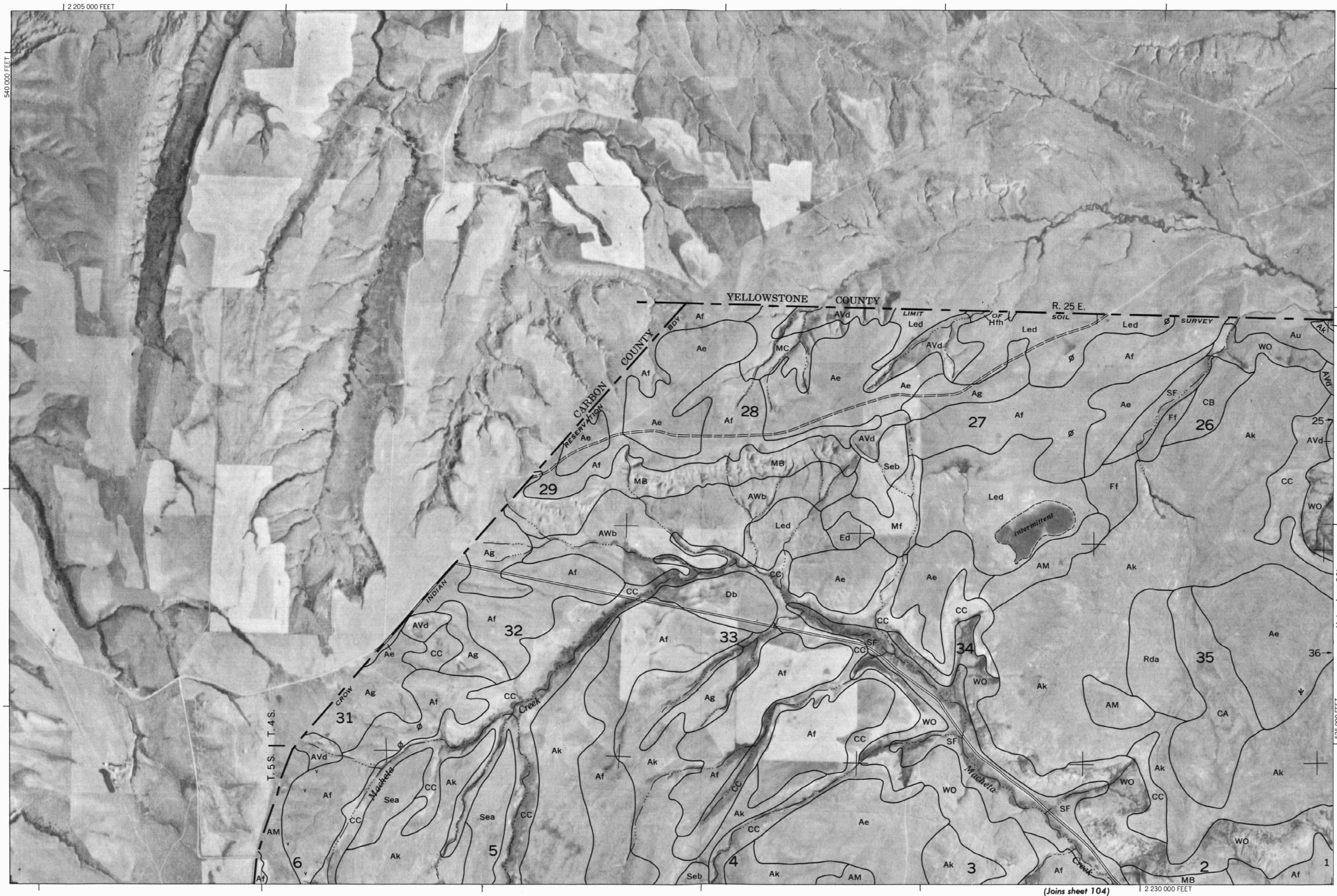
This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.  
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



BIG HORN COUNTY AREA, MONTANA NO. 89

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

Coordinate grid ticks and land division corners, if shown, are approximately positioned.



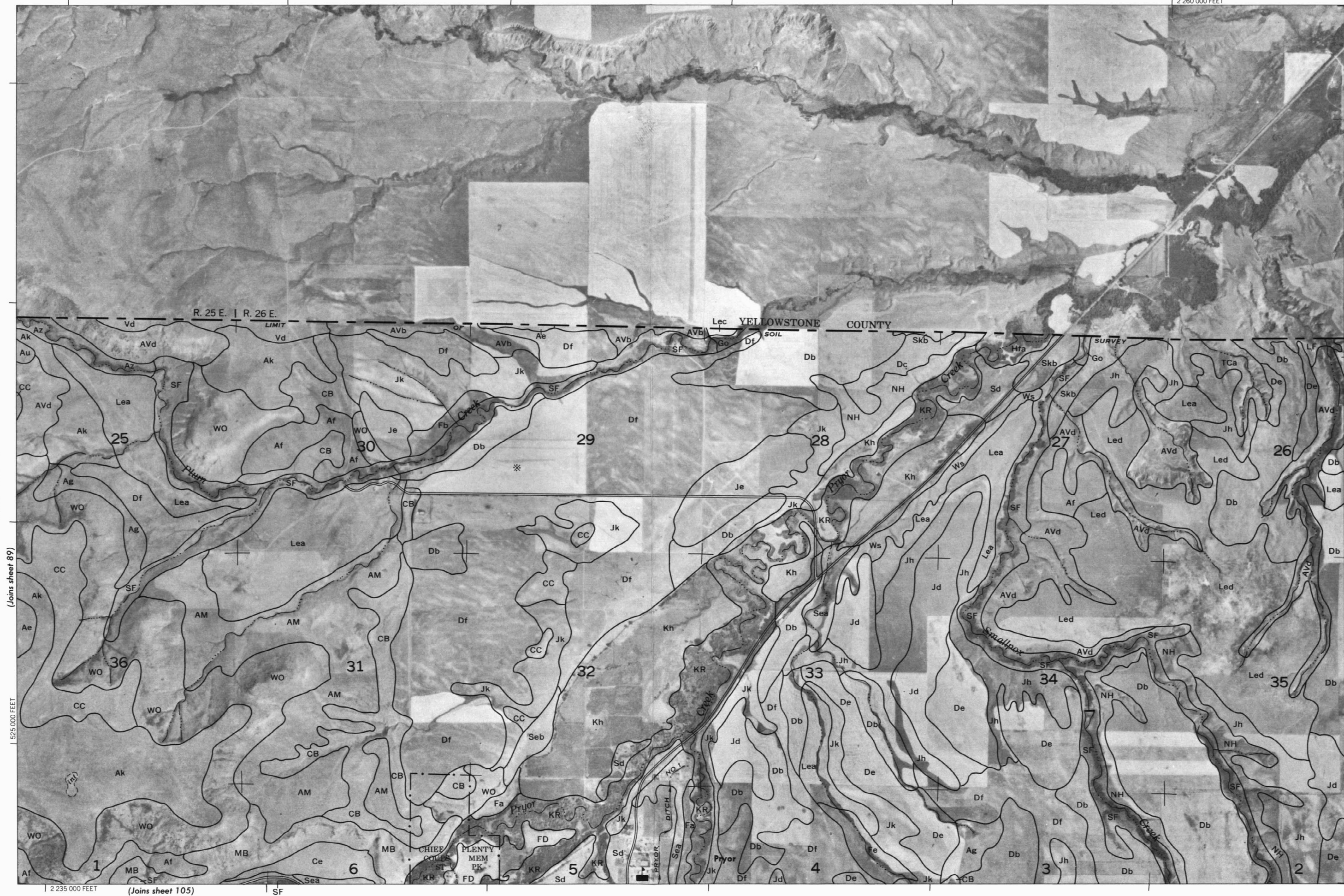
(Joins sheet 104)

2 230 000 FEET

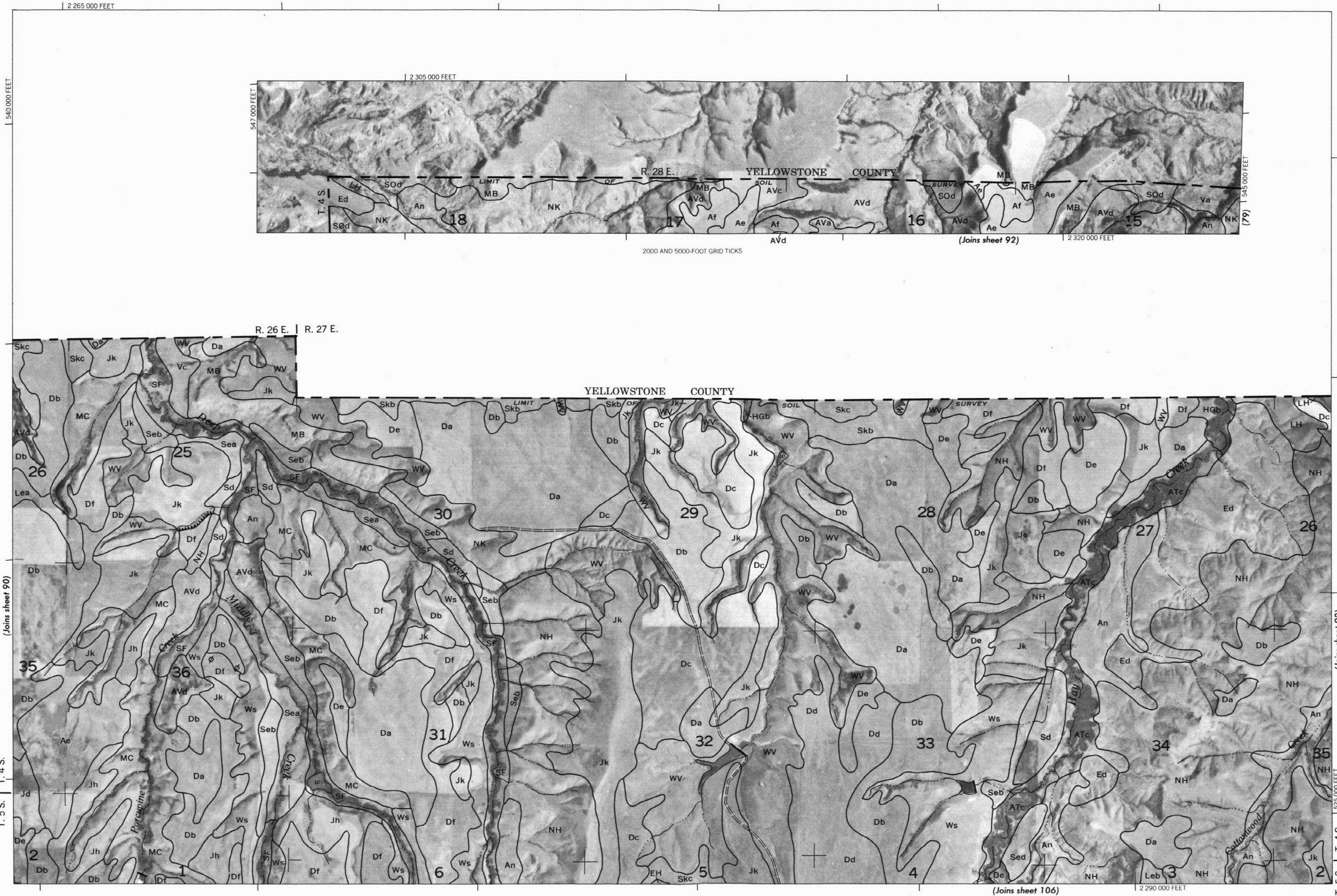
(Joins sheet 90)

525 000 FEET



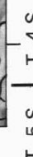






BIG HORN COUNTY AREA, MONTANA NO. 91  
This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.  
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

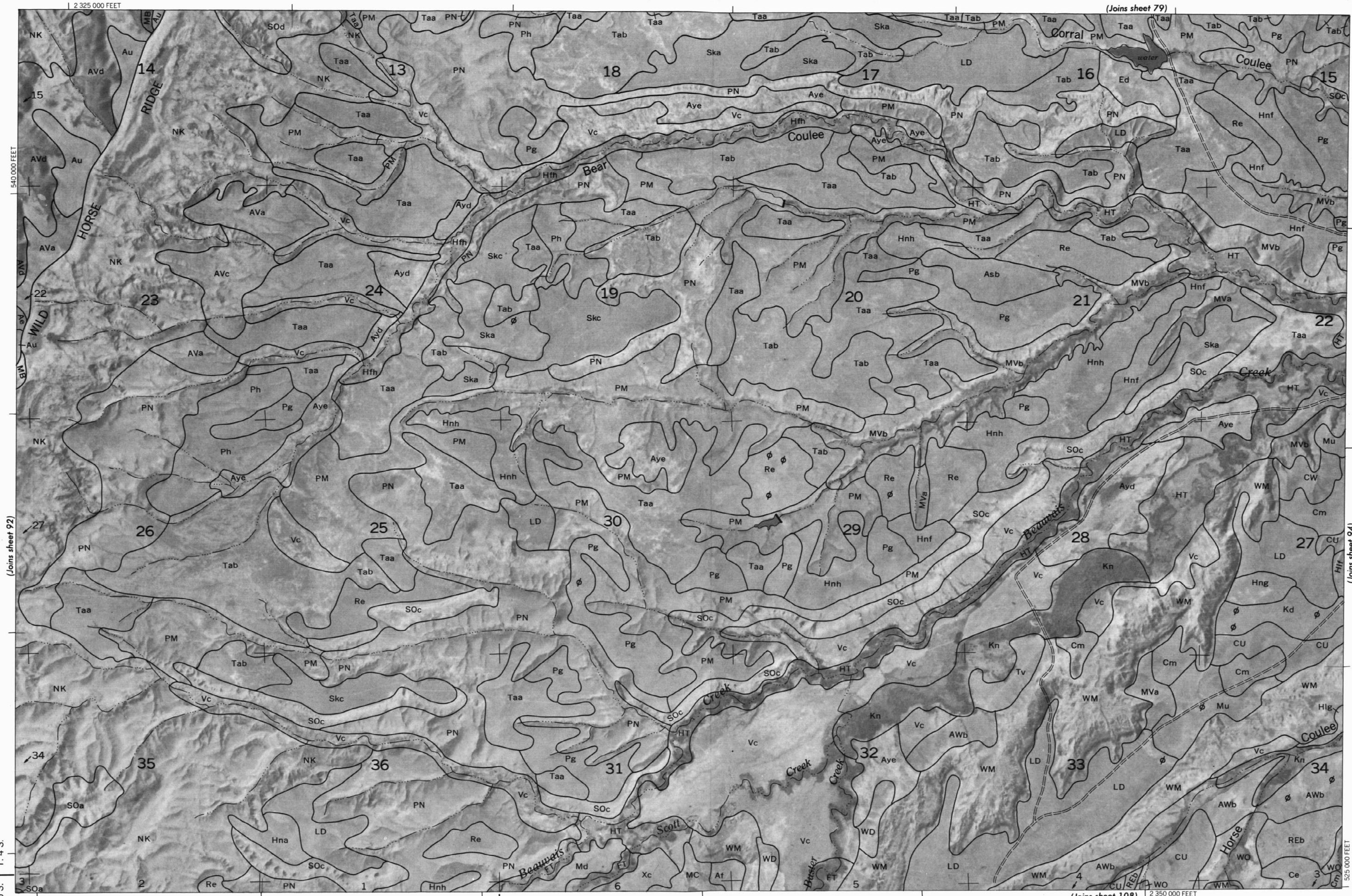




BIG HORN COUNTY AREA, MONTANA • NO. 92



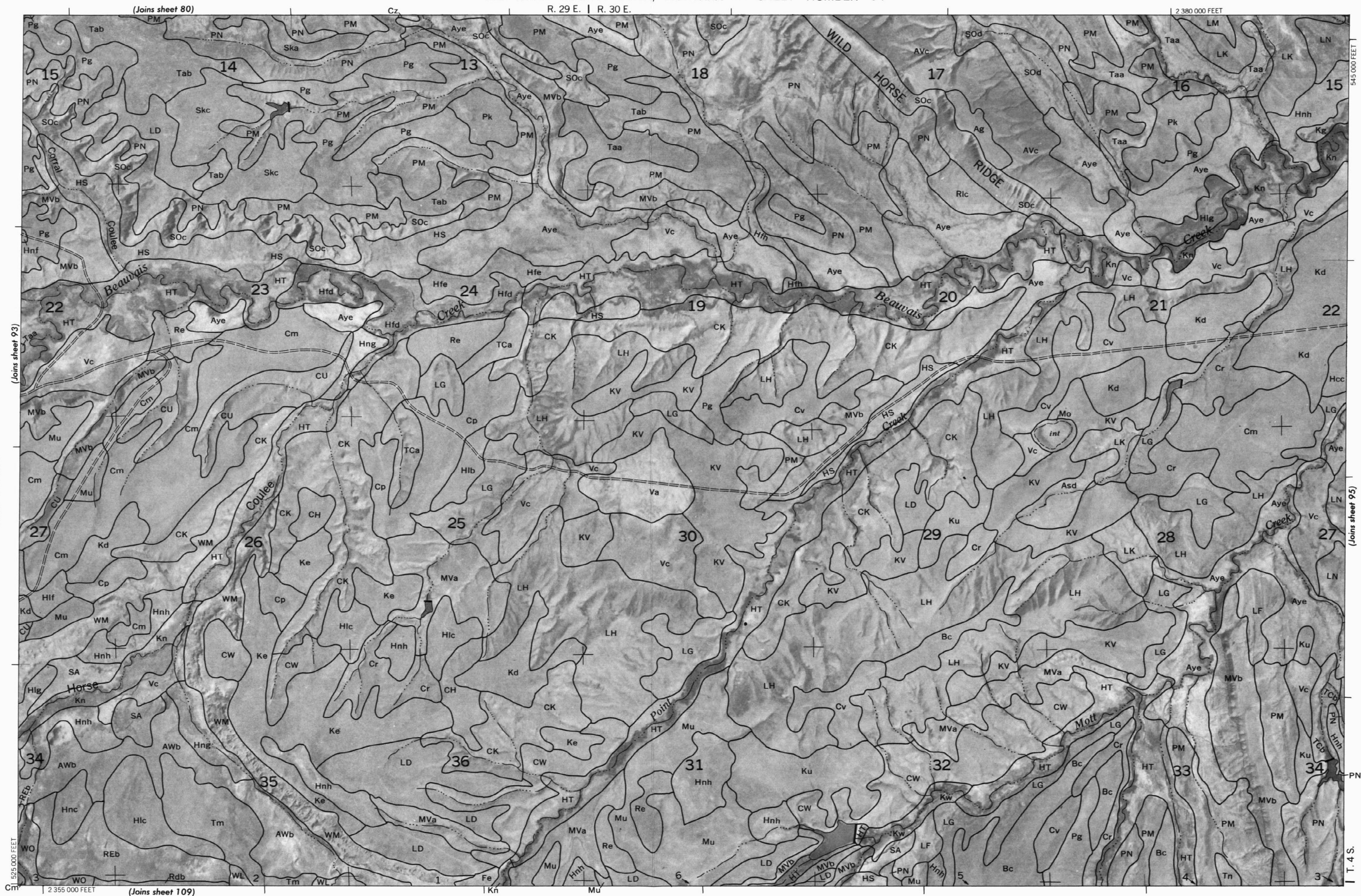
This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



T. 5 S. | T. 4 S.  
R. 28 E. | R. 29 E.

(Joins sheet 108) 2 350 000 FEET







(Joins sheet 81)



(Joins sheet 110) | 2 410 000 FEET

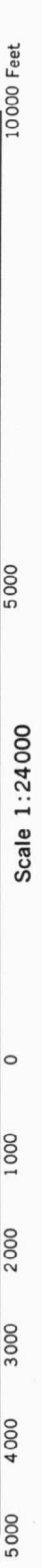
This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.







(Joins sheet 83)



2 470 000 FEET

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



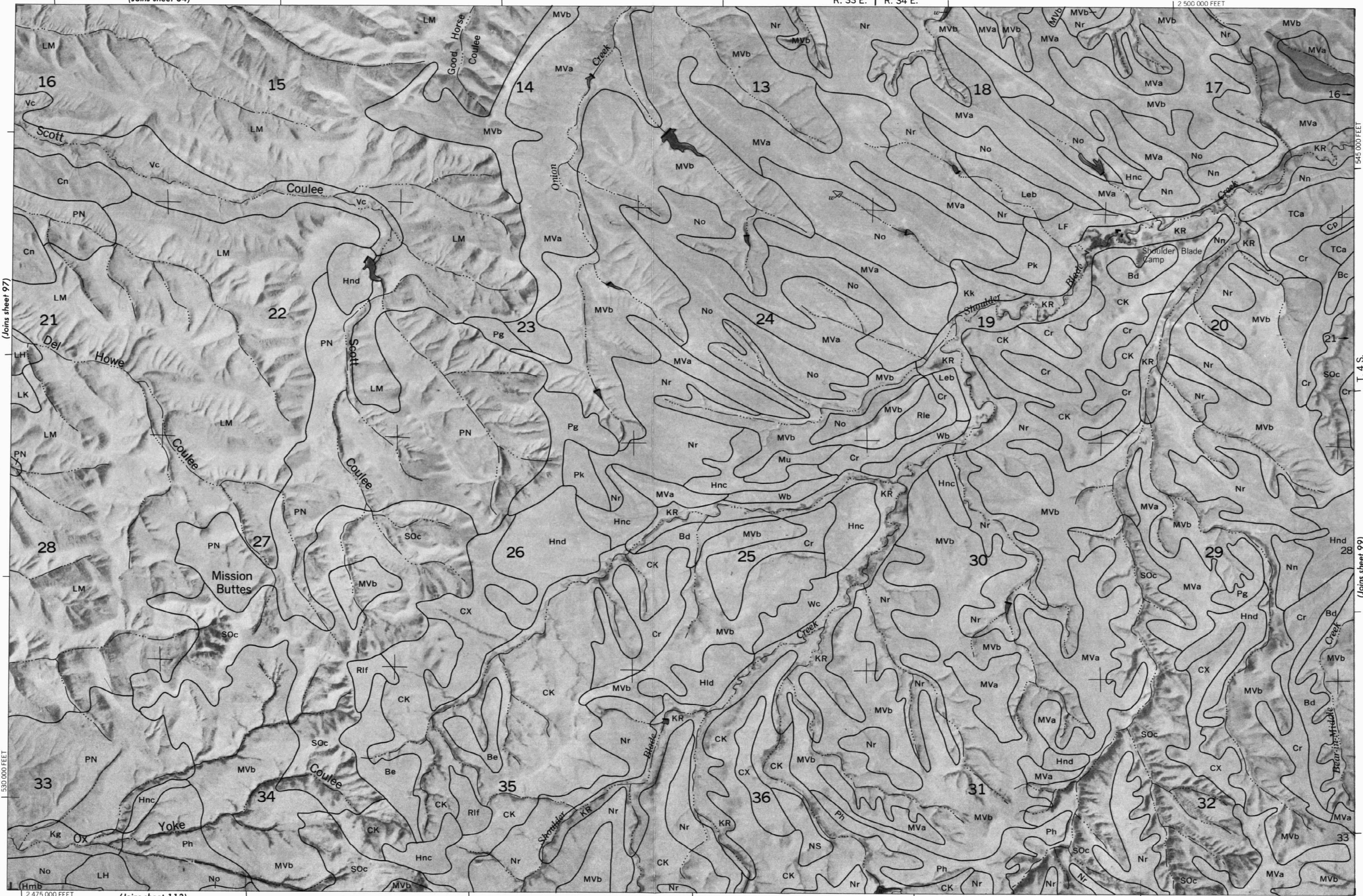
(Joins sheet 84)

2 500 000 FEET



(Joins sheet 97)

Scale 1:24 000



T. 4 S.

(Joins sheet 99)

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.  
Coordinate grid ticks and land division corners, if shown, are approximately positioned



N



10 000 Feet

5000

Scale 1:24000

0

00

1

Q

20

00

00

1

0

50

(Joins sheet 114) | 2 530 000 FEET

(Joins sheet 98)

(Joins sheet 100)

T.4S.1

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

Coordinate grid ticks and land division corners, if shown, are approximately positioned.



(Joins sheet 86)



Scale 1:24 000

(Joins sheet 99)

530 000 FEET

2 535 000 FEET

(Joins sheet 115)



(Joins sheet 101)

T. 5 S. | T. 4 S.



BIG HORN COUNTY AREA, MONTANA — SHEET NUMBER 101

R. 36 E. | R. 37 E. (Joins sheet 87)

101



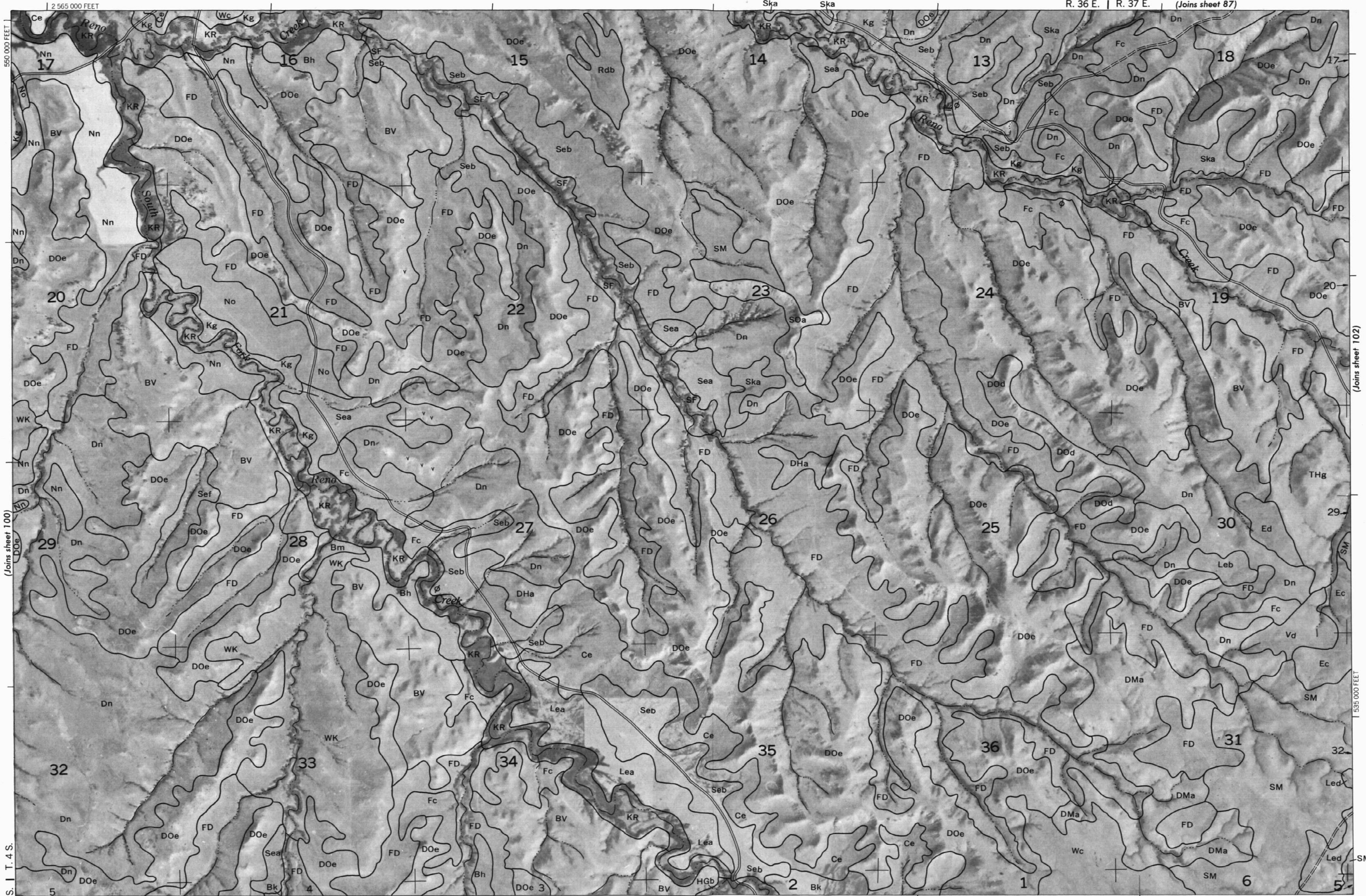
2 Miles  
10000 Feet

Scale 1:24000

0 0 1000 2000 3000 4000 5000  
1 1/4 1/2 1/4 1/8

535 000 FEET

(Joins sheet 116) 2 590 000 FEET



2 565 000 FEET

(Joins sheet 100)

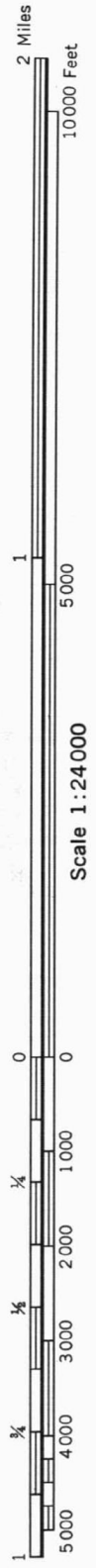
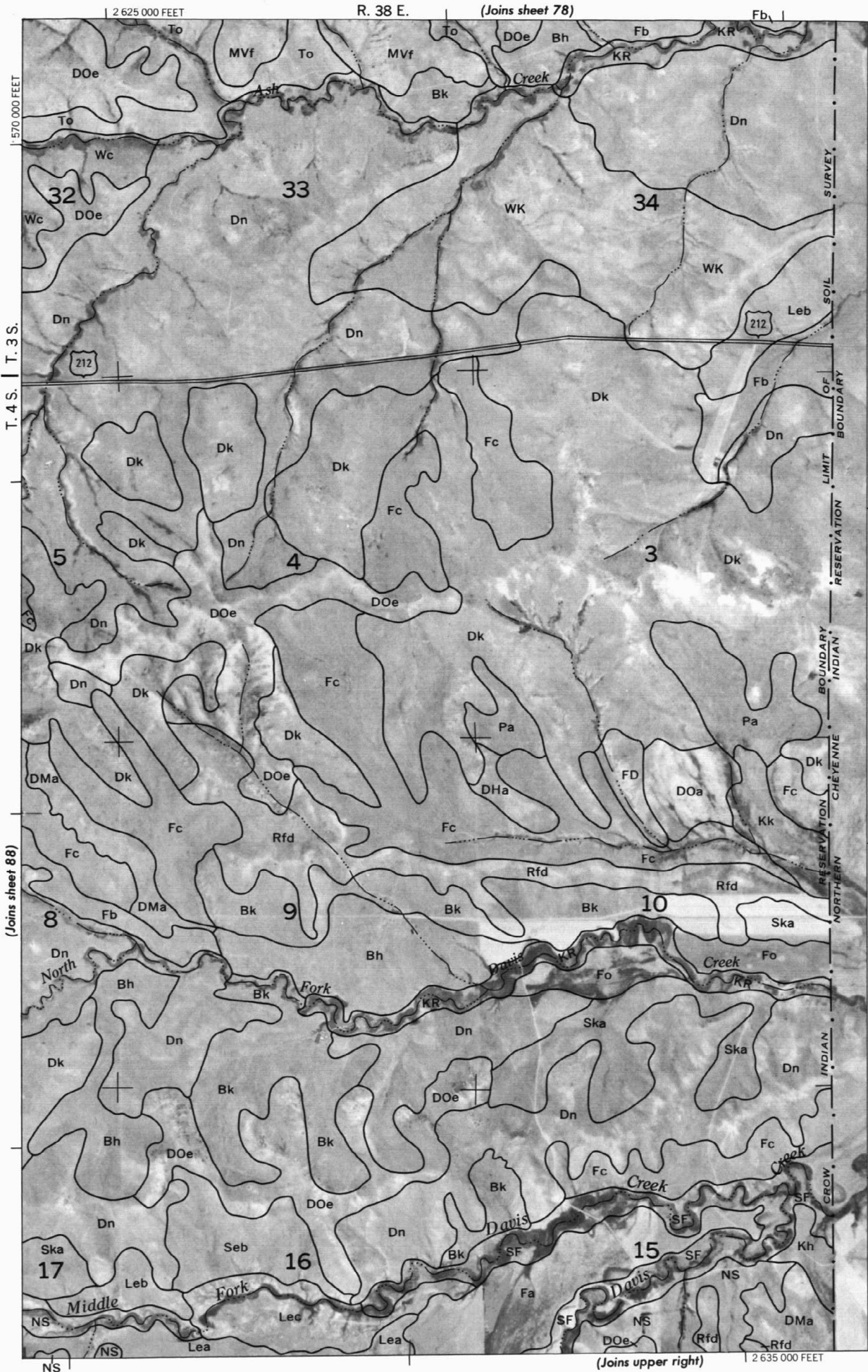
T. 5 S. | T. 4 S.

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



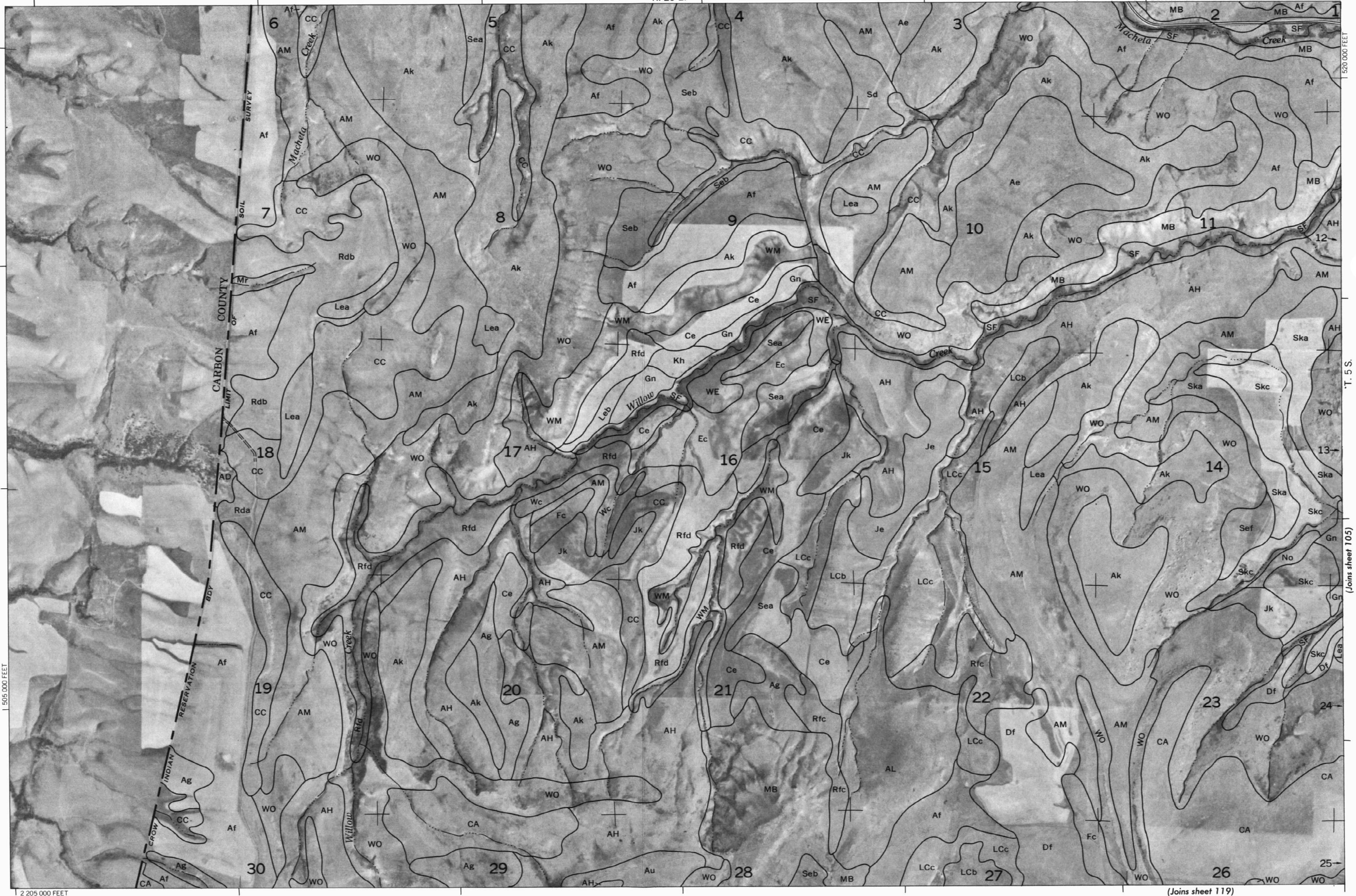






This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.









(Joins sheet 106)

Scale 1:24 000

Number of Children	Percentage of Families
0	~10%
1	~35%
2	~30%
3	~15%
4	~5%
5	~5%

(Joins sheet 120) | 2 260 000 FEET

| 2 235 000 FEET

T. 5 S.

(Joins sheet 104)

103

•

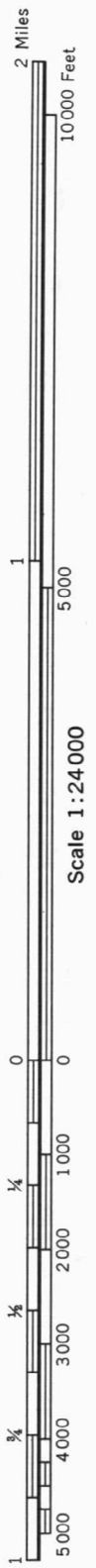
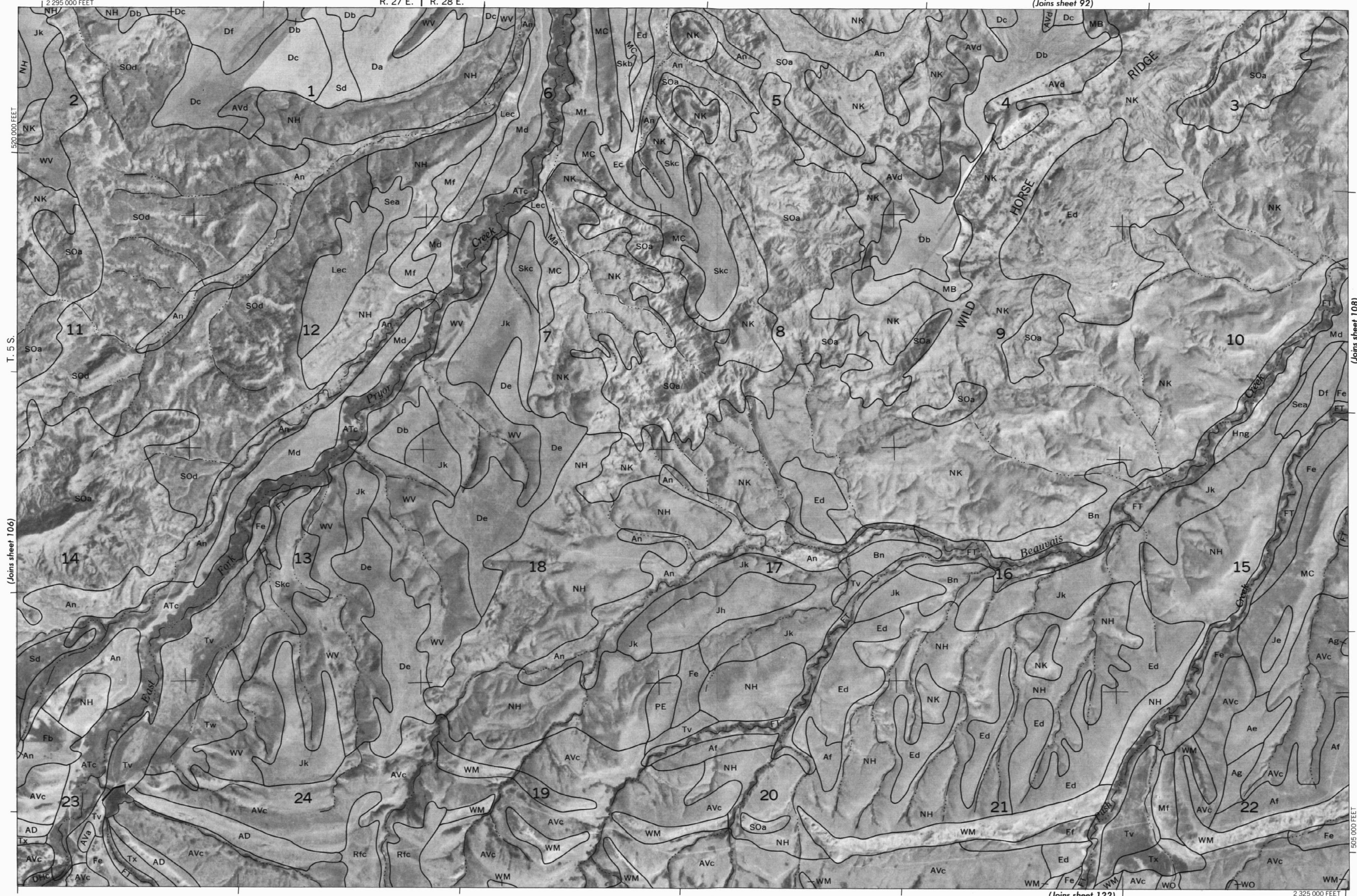
1

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.









This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



A scale bar with two segments. The top segment is labeled '2 Miles' and the bottom segment is labeled '10000 Feet'.

1  
5000

Scale 1:24 000

2 330 000 FEET

R. 28 E.	R. 29 E.
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(Joins sheet 109) T. 5 S.

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.







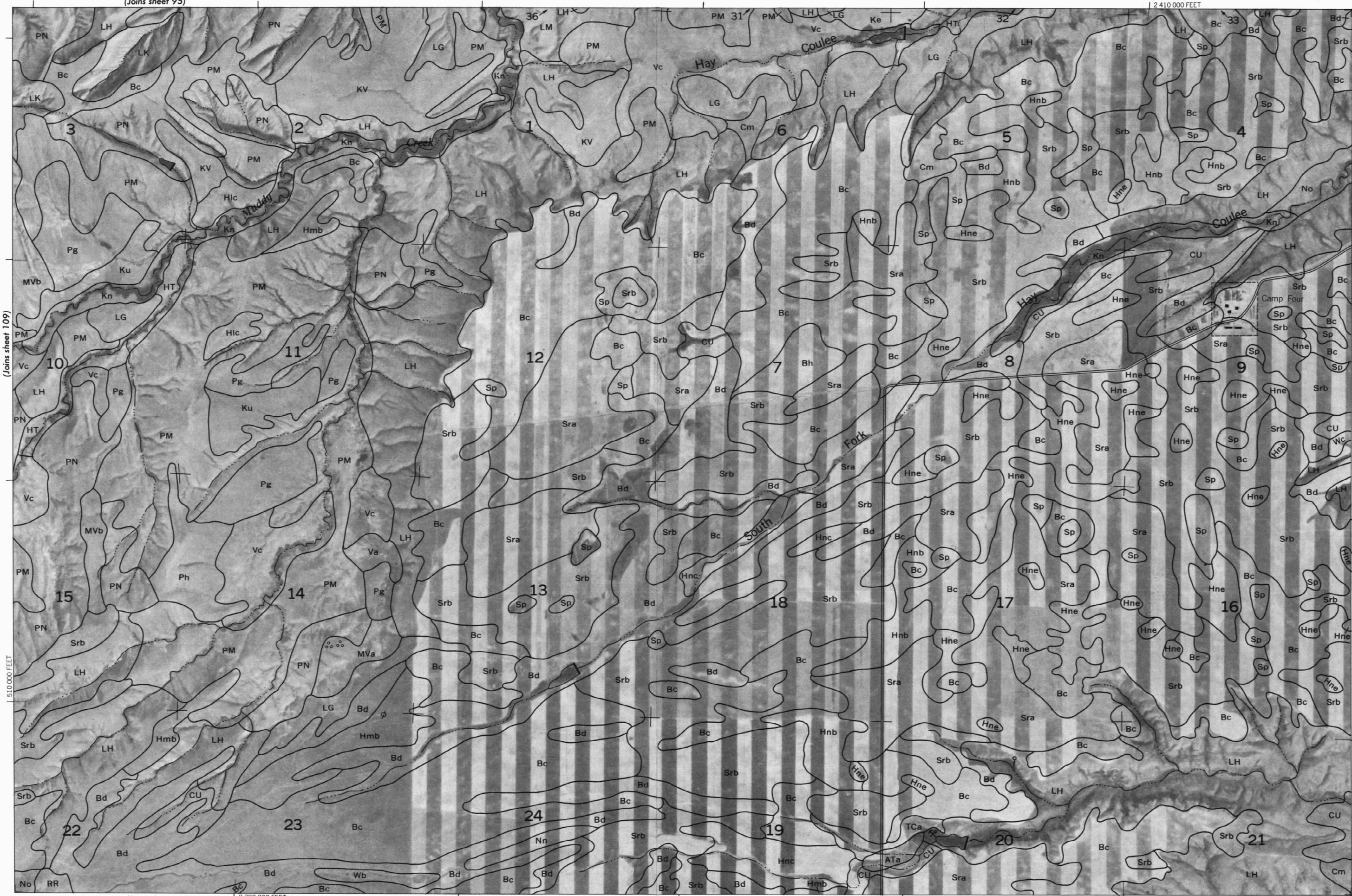
(Joins sheet 95)

2 410 000 FEET



Scale 1:24 000

(Joins sheet 109)



(Joins sheet 125)

2 390 000 FEET

R. 30 E. | R. 31 E.

(Joins sheet 111)

T. 5 S.

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



(Joins sheet 96)

2 Miles

10000 Feet

1111

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1111

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1

5000

1111

24 000

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466
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2000

34

1,000	30
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[illegible]

5000

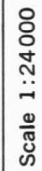
(Joins sheet 126)

2 445 000 FEET

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



2 470 000 FEET



(Joins sheet 113)



510 000 FEET

Scale 1:24 000

2 505 000 FEET |

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



| 2 530 000 FEET

1F

000  
(Joins sheet 113)

Scale 1:24 000

0/

1



34

1

1

L

(Joins sheet 129)

2 510 000 FEET

R. 34 E.

R. 35 E.

525 000 FEET

T. 55.

(Joins sheet 115)

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned





2 Miles

10000 Feet

1

5000

Scale 1:24 000

515 000 FEET

0 0

1/4 1/4

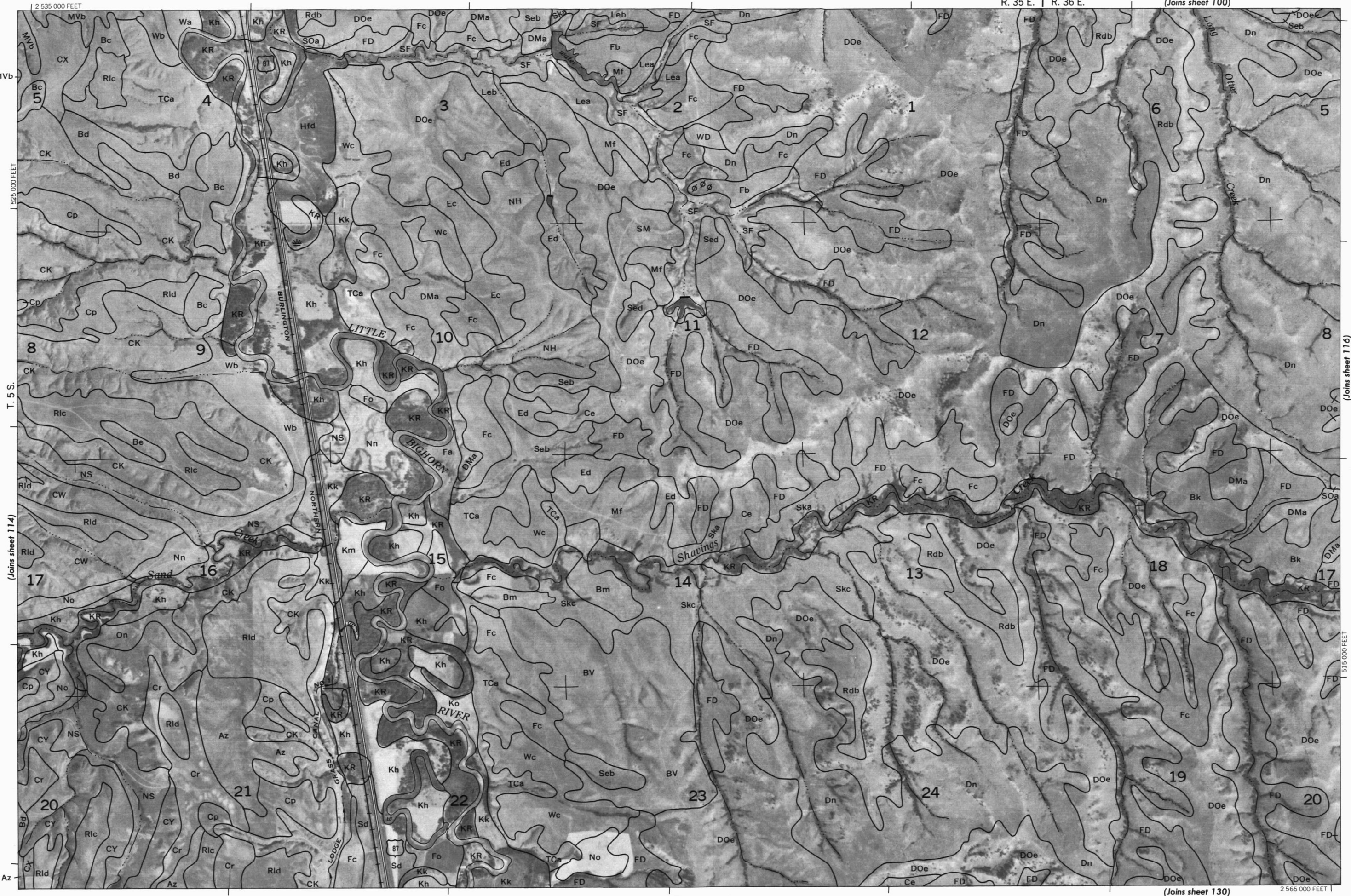
2000 3000

4000 5000

1

2 565 000 FEET

(Joins sheet 130)



T. 5 S.

(Joins sheet 114)

Az

2 535 000 FEET

525 000 FEET

MVb

5

8

17

20

4

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16

21

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15

22

2

11

14

23

1

12

13

24

6

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18

19

5

8

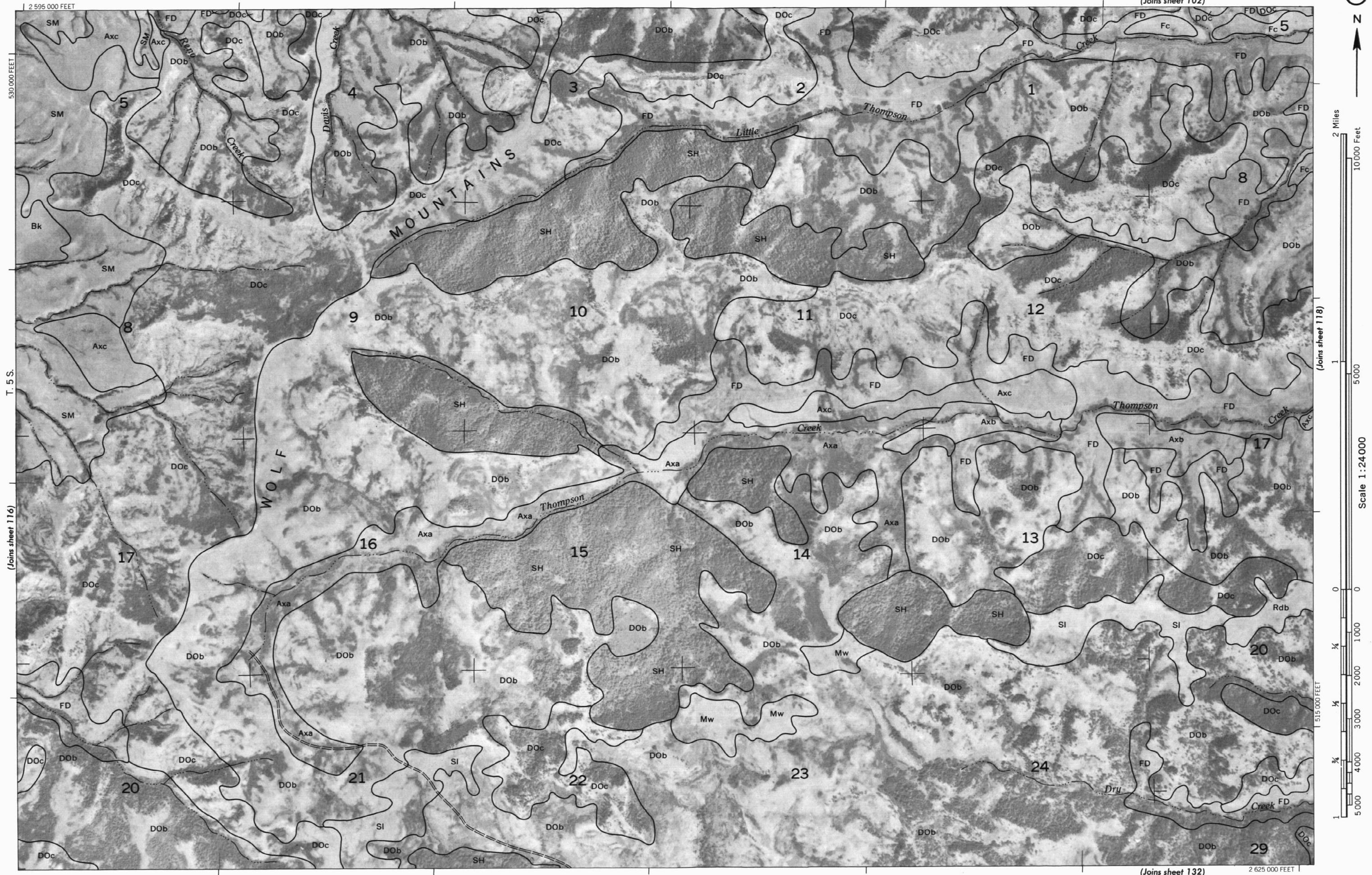
17

20









This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

T. 5 S.

(Joins sheet 116)

(Joins sheet 118)

(Joins sheet 132)

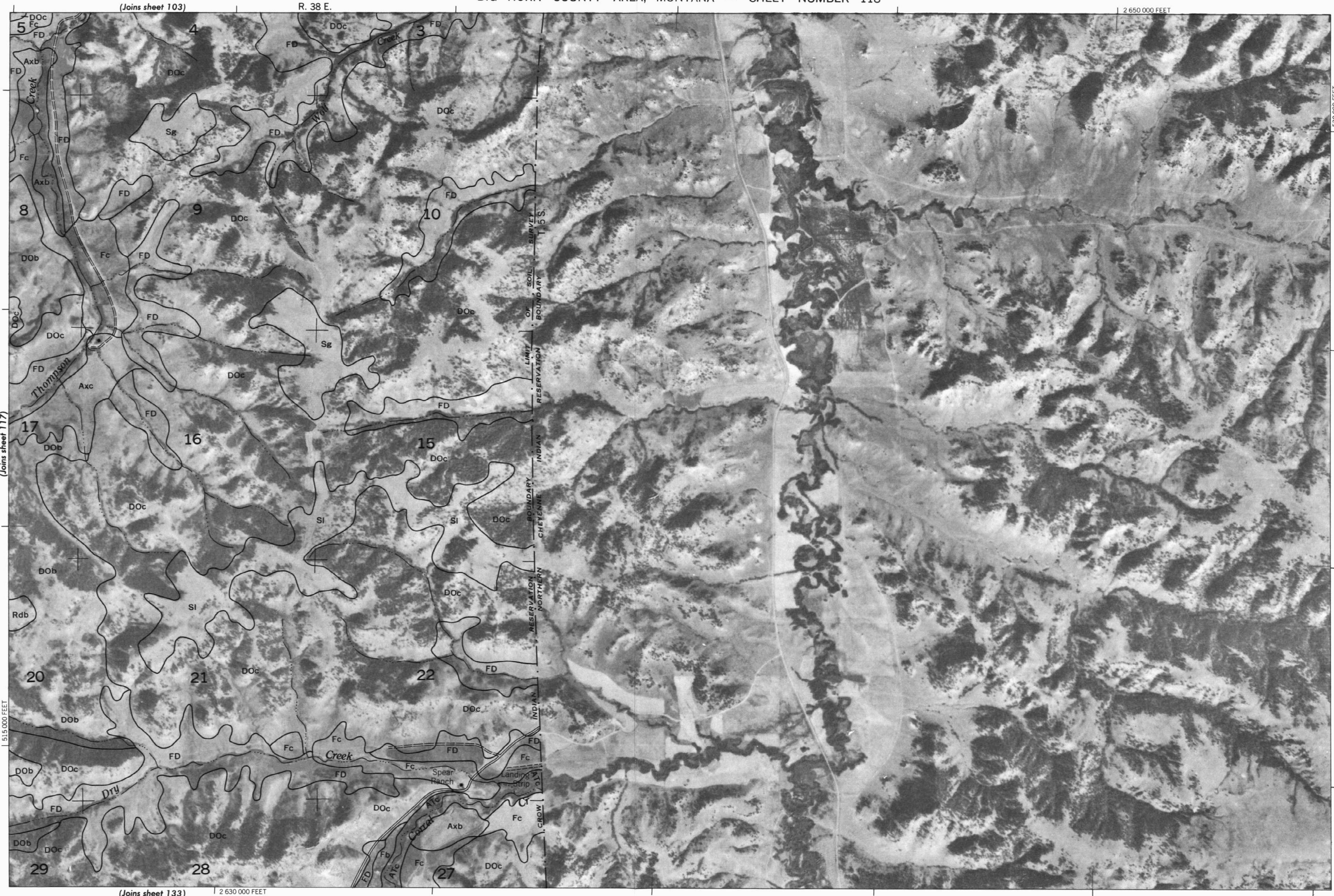
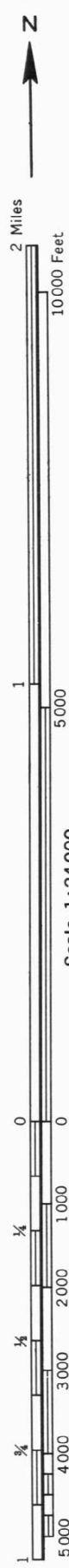
2 625 000 FEET

2 Miles

10 000 Feet

Scale 1:24 000





(Joins sheet 103)

R. 38 E.

2 650 000 FEET

(Joins sheet 117)

(Joins sheet 133)

2 630 000 FEET

530 000 FEET



(Joins sheet 104)

(Joins sheet 120)

Scale 1:24,000

0 1000 2000 3000 4000 5000 Feet

0 1 2 Miles

Scale 1:24 000

2 235 000 FEET |

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



T. 6 S. | T. 5 S.

(Joins sheet 121)

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



(Joins sheet 119)

Scale 1:24 000

R. 25 E. | R. 26 E.

2 240 000 FEET (Joins sheet 137)

(Joins sheet 137)





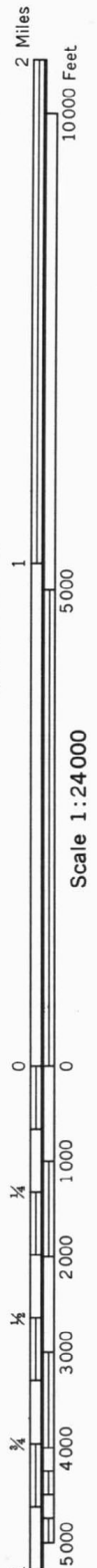
This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

Scale 1:24000









This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



(Joins sheet 109)

R. 29 E. | R. 30 E.

2 385 000 FEET

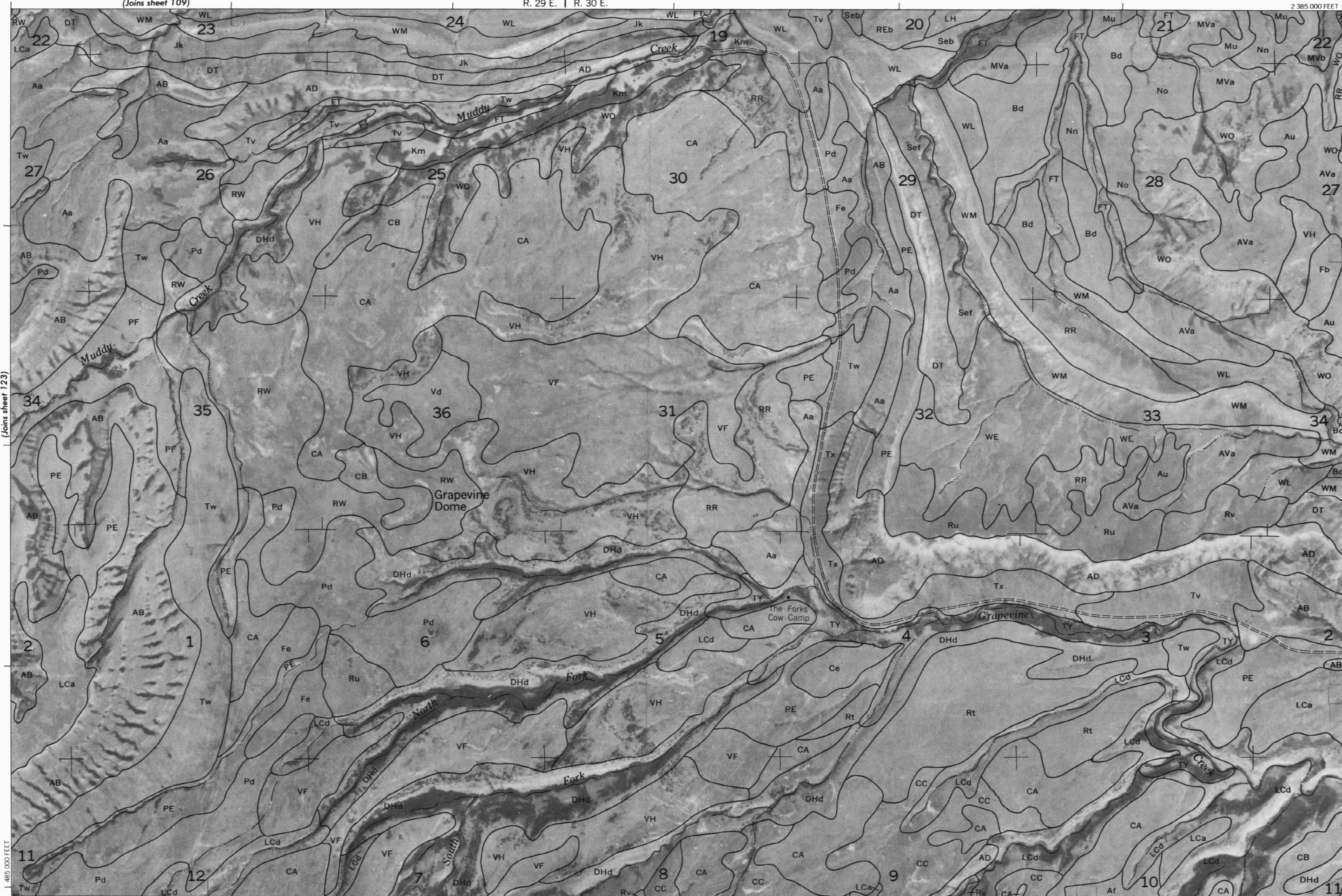


2 Miles  
10 000 Feet

1  
5 000

Scale 1:24 000

0 0  
1 000  
2 000  
3 000  
4 000  
5 000



(Joins sheet 141)

R. 29 E. | R. 30 E.

2 360 000 FEET

(Joins sheet 125)

T. 6 S. | T. 5 S.

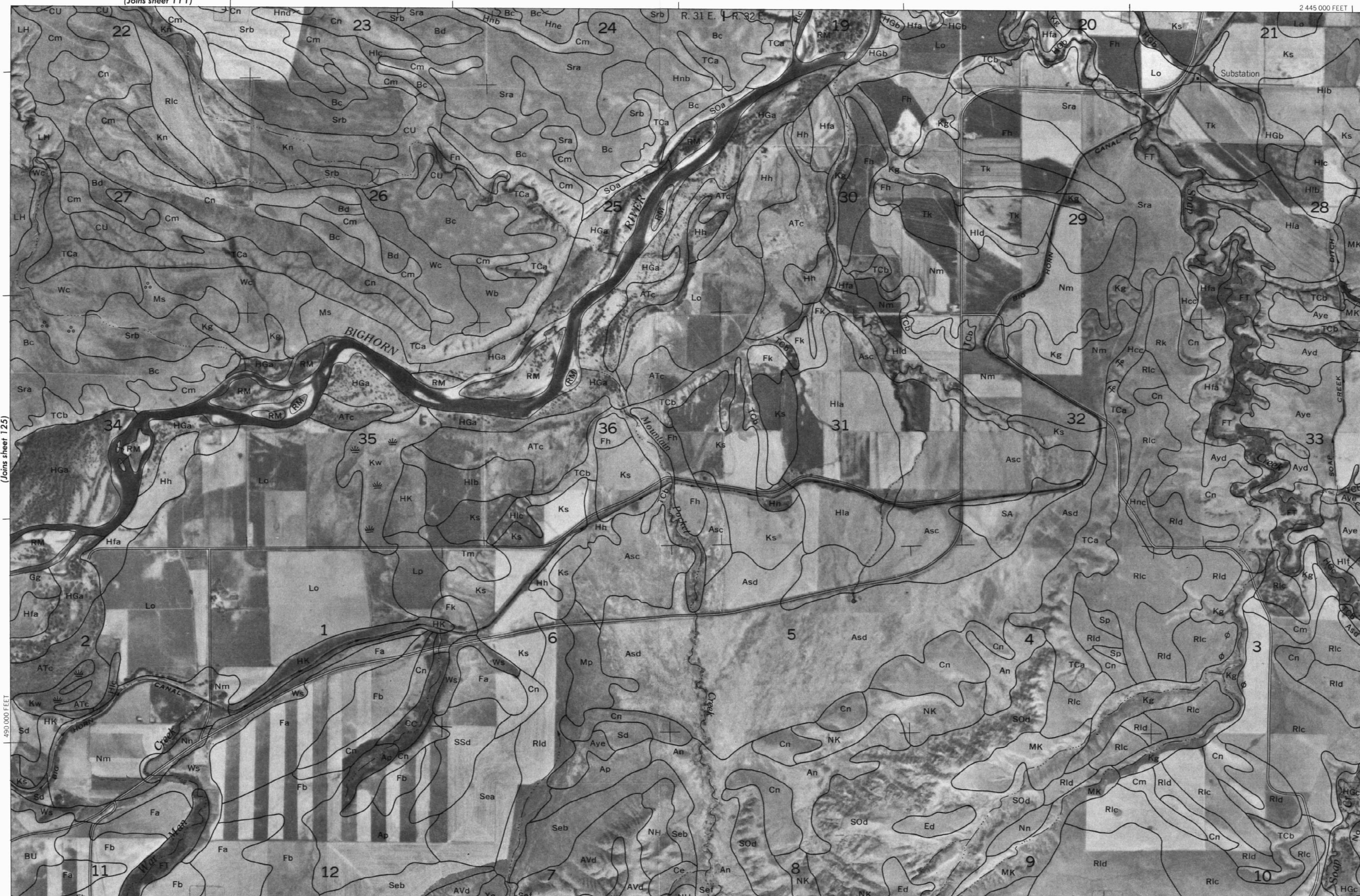
This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.





Scale 1:24 000





2 445 000 FEET

T. 6 S. | T. 5 S.

(Joins sheet 127)

(Joins sheet 143) R. 31 E. | R. 32 E.

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

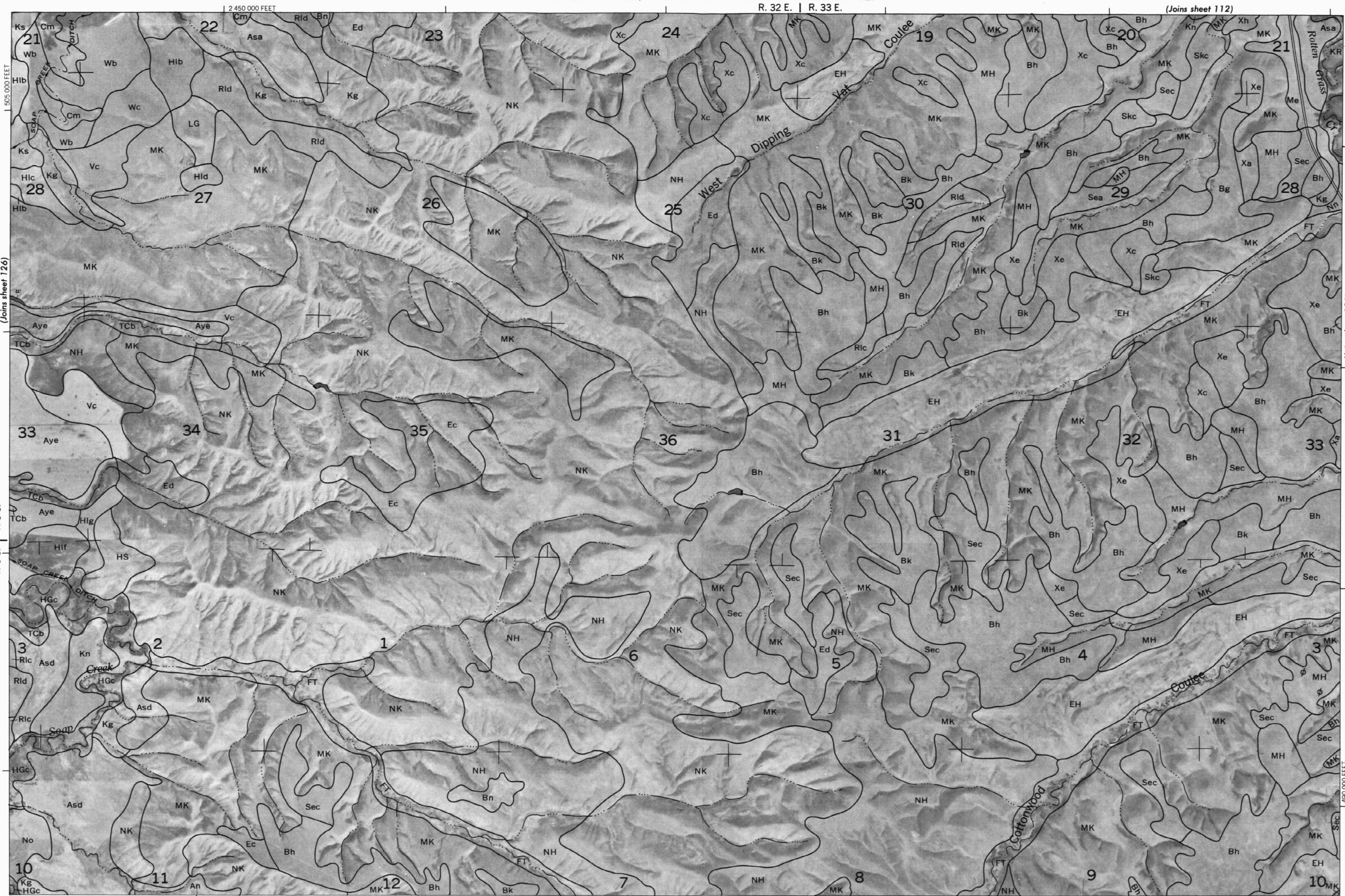


(Joins sheet 126)

T. 6 S.	T. 5 S.
---------	---------

(Joins sheet 128)

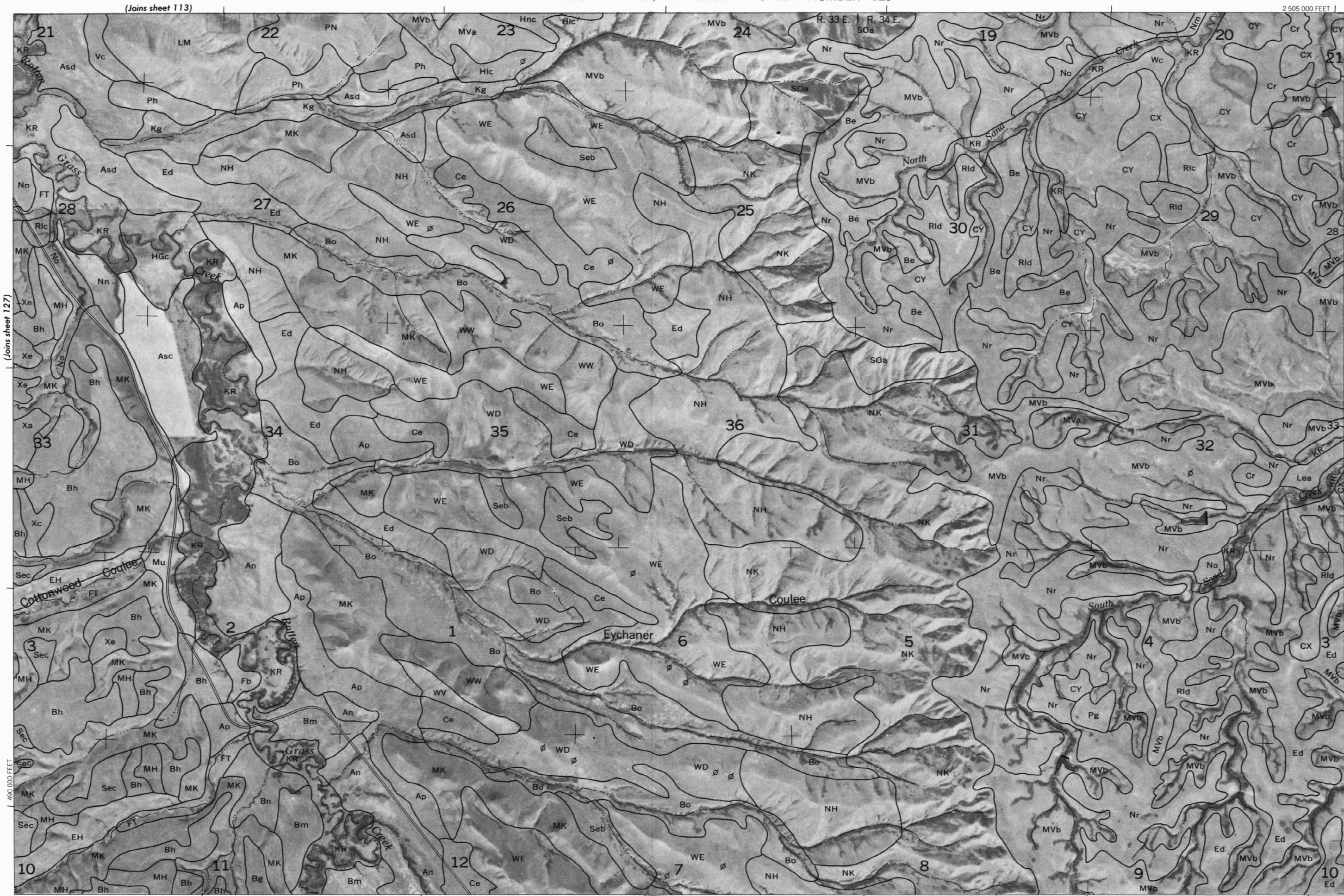
Scale 1:24 000







Scale 1:24,000



(Joins sheet 145) 2 480 000 FEET

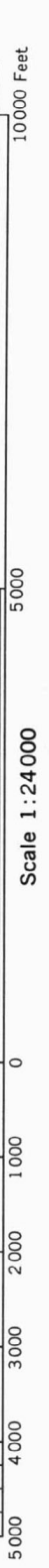
R. 33 E. | R. 34 E.

(Joins sheet 129) T. 5 S. | T. 6 S.

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



(Joins sheet 114)



(Joins sheet 146)

2 535 000 FEET |



(Joins sheet 147)

(Joins sheet 131)

T.6S. | T.5S.

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



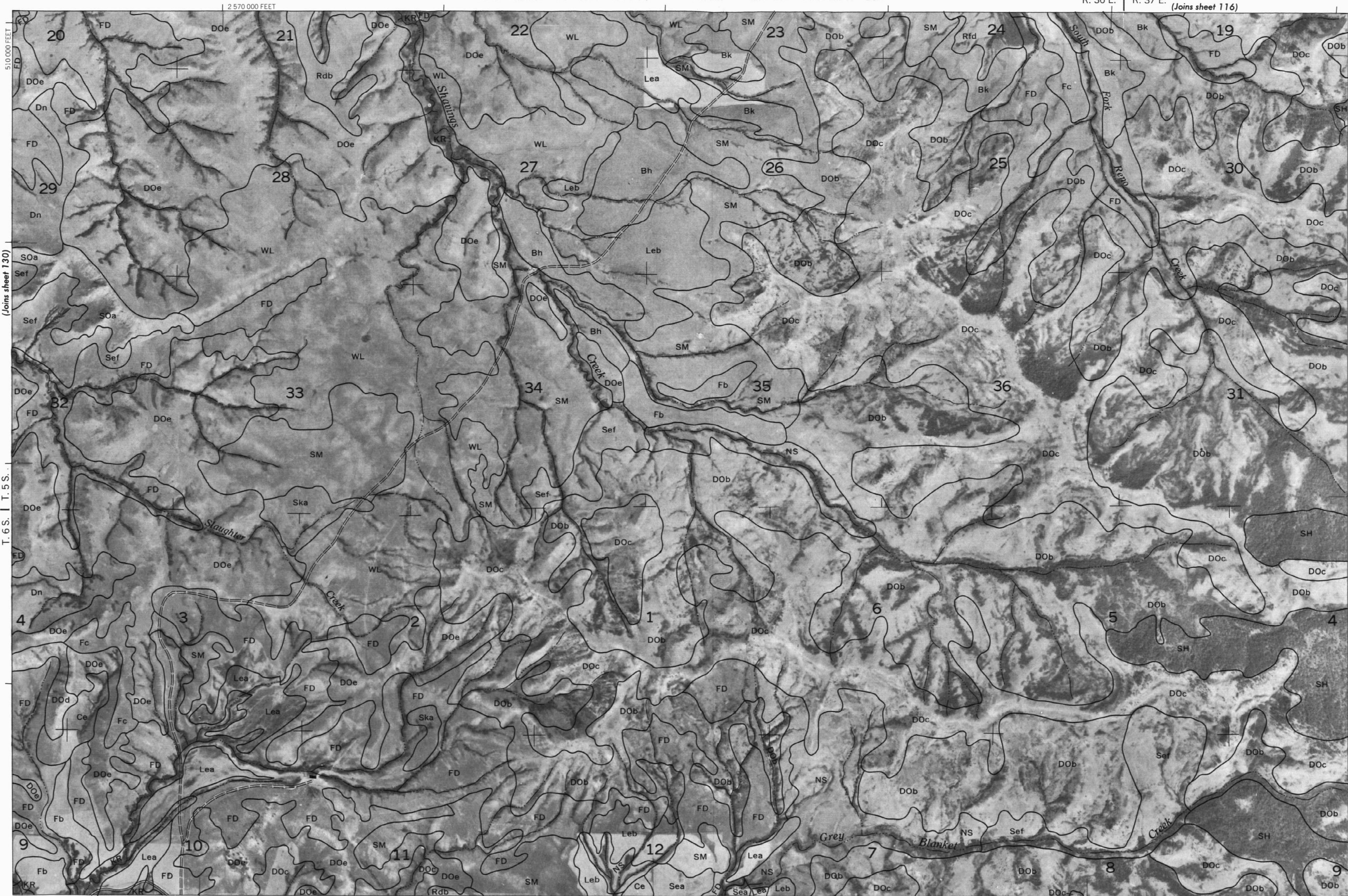


2 Miles  
10000 Feet

1  
5000

Scale 1:24000

1  
5000  
4000  
3000  
2000  
1000  
0  
0  
0



This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.  
Coordinate grid ticks and land division corners, if shown, are approximately positioned.





2 Miles  
10 000 Feet

1  
5 000  
(Joins sheet 131)

Scale 1:24 000  
T. 6 S. | T. 5 S.

0 0 1 000 2 000 3 000 4 000 5 000  
495 000 FEET

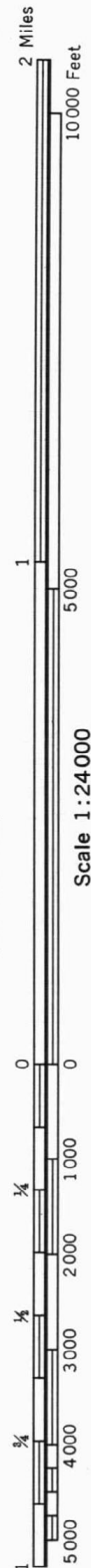


2 600 000 FEET (Joins sheet 149)

R. 37 E. | R. 38 E.

T. 6 S. | T. 5 S. (Joins sheet 133)





2 655 000 FEET |

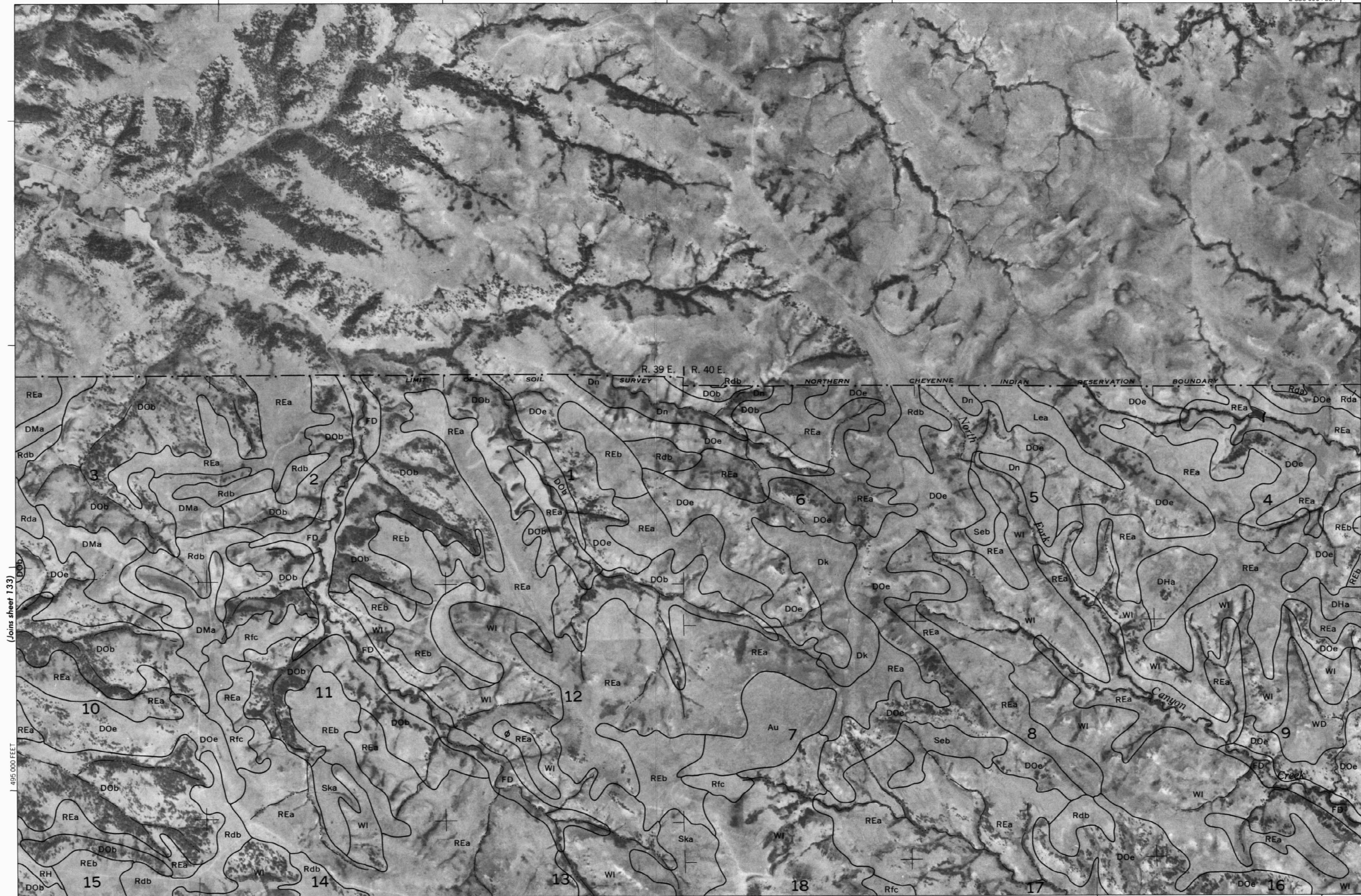




2 Miles  
10 000 Feet

1 5 000  
Scale 1:24 000

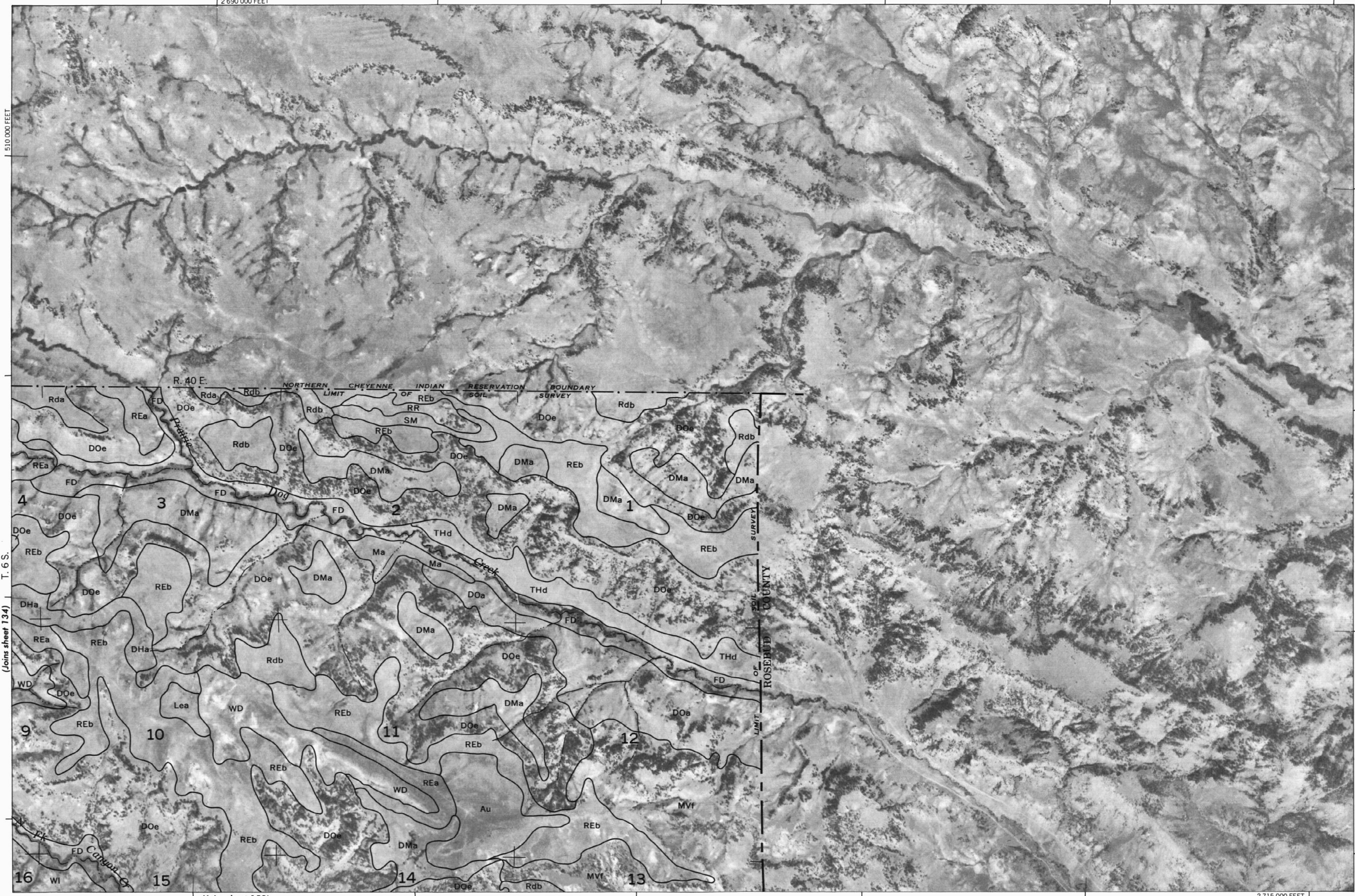
0 1 000 2 000 3 000 4 000 5 000  
495 000 FEET



(Joins sheet 151) 2 660 000 FEET

(Joins sheet 135) T. 6 S.





510 000 FEET

2 690 000 FEET

2 Miles

10 000 Feet

Scale 1:24 000

495 000 FEET

2 715 000 FEET



This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(Joins sheet 134) T. 6 S.

(Joins sheet 152)





2 Miles  
10 000 Feet

1  
5 000

Scale 1:24 000

0 0

1/4 1 000

1/2 2 000

3/4 3 000

1 4 000

5 000

1/4 1 000

1/2 2 000

3/4 3 000

1 4 000

5 000



2 210 000 FEET

(Joins sheet 153)

R. 25 E. | R. 26 E.

T. 6 S.

(Joins sheet 137)







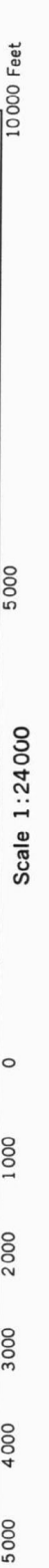
59

(Joins sheet 139)

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.











2 Miles

10 000 Feet

1

5000

Scale 1:24000

0

0

1000

2000

3000

4000

5000

1

465 000 FEET

LITTLE

MOUNTAIN

Muddy

Hoodoo

Pitchfork

Creek

(Joins sheet 157)

(Joins sheet 141)

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



N

Scale 1-24,000

2 385 000 FEET

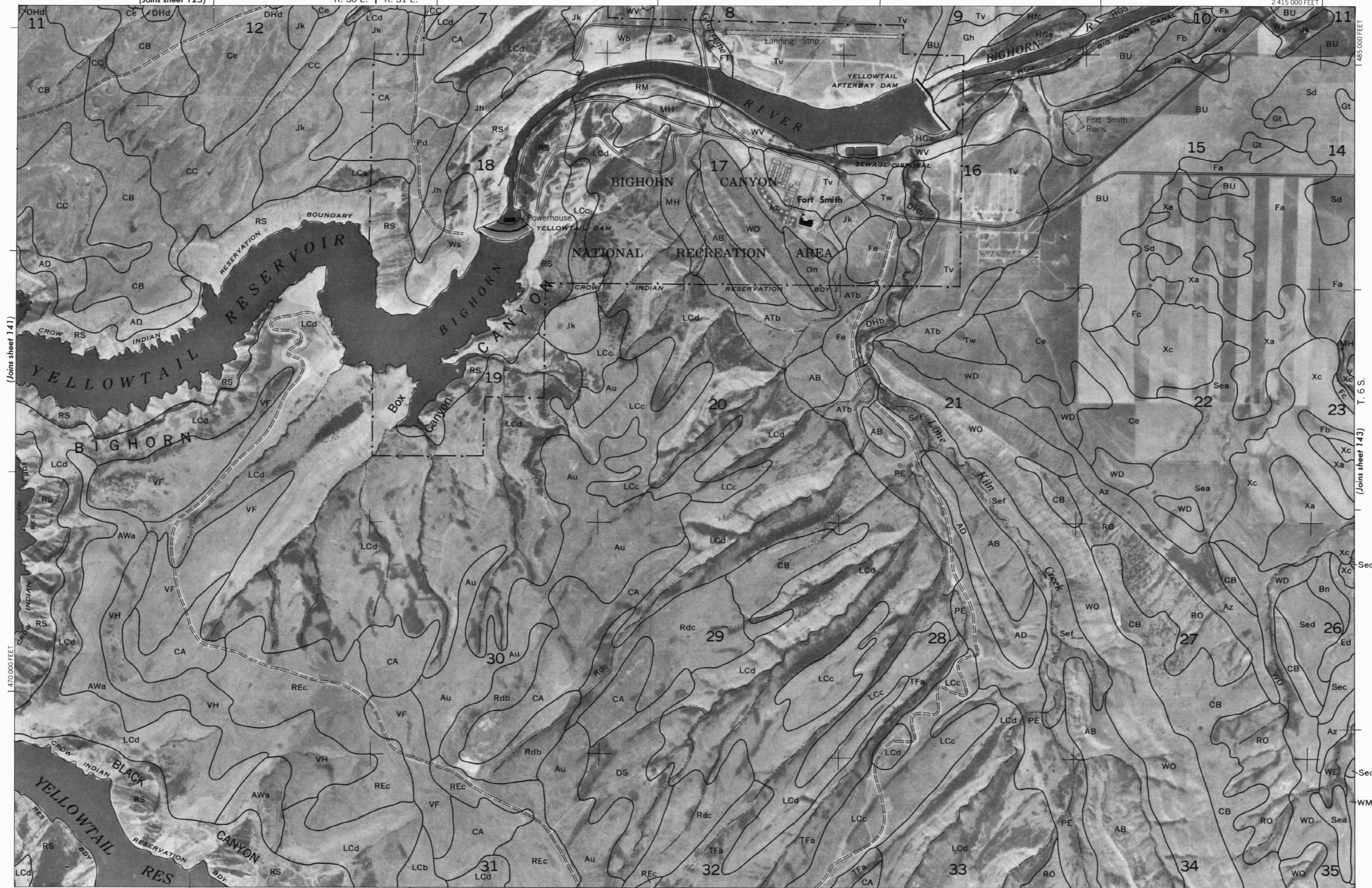
This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



(Joins sheet 125)

R. 30 E. | R. 31 E.

2 415 000 FEET



2 390 000 FEET

(Joins sheet 159)

(Joins sheet 143)

T. 6 S.





This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

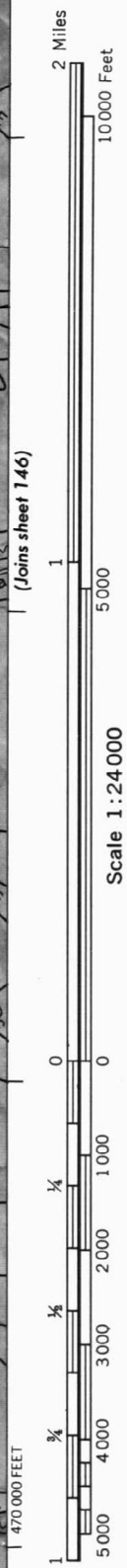




This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



(Joins sheet 144) | T. 6 S.



(Joins sheet 162)

2 505 000 FEET



(Joins sheet 129)

2 535 000 FEET



2 Miles

10000 Feet

1

5000

Scale 1:24000

0

0

1000

2000

3000

4000

5000

1

1/4

1/2

3/4

1

1/4

1/2

3/4

1

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3/4

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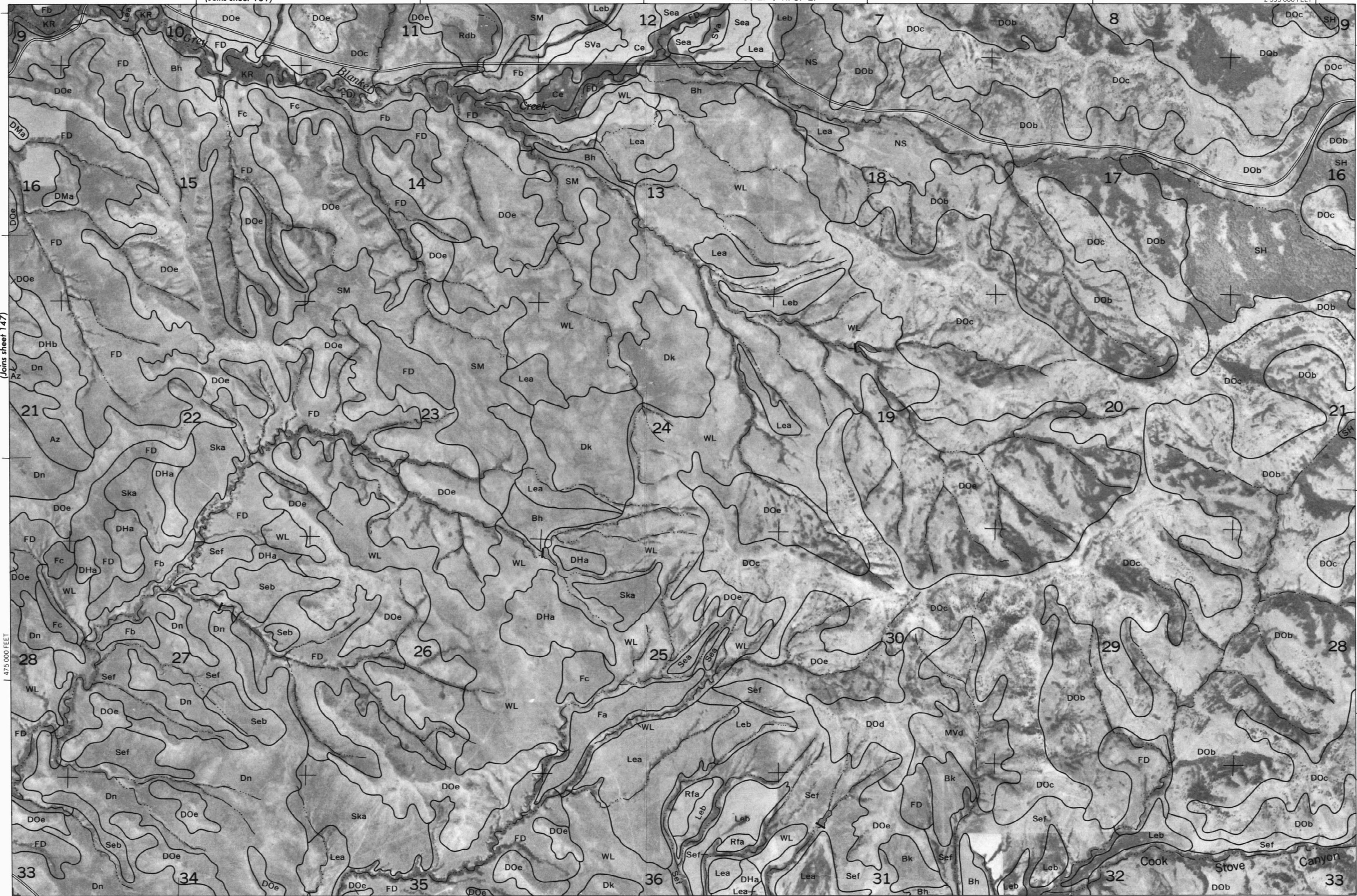


2 565 000 FEET



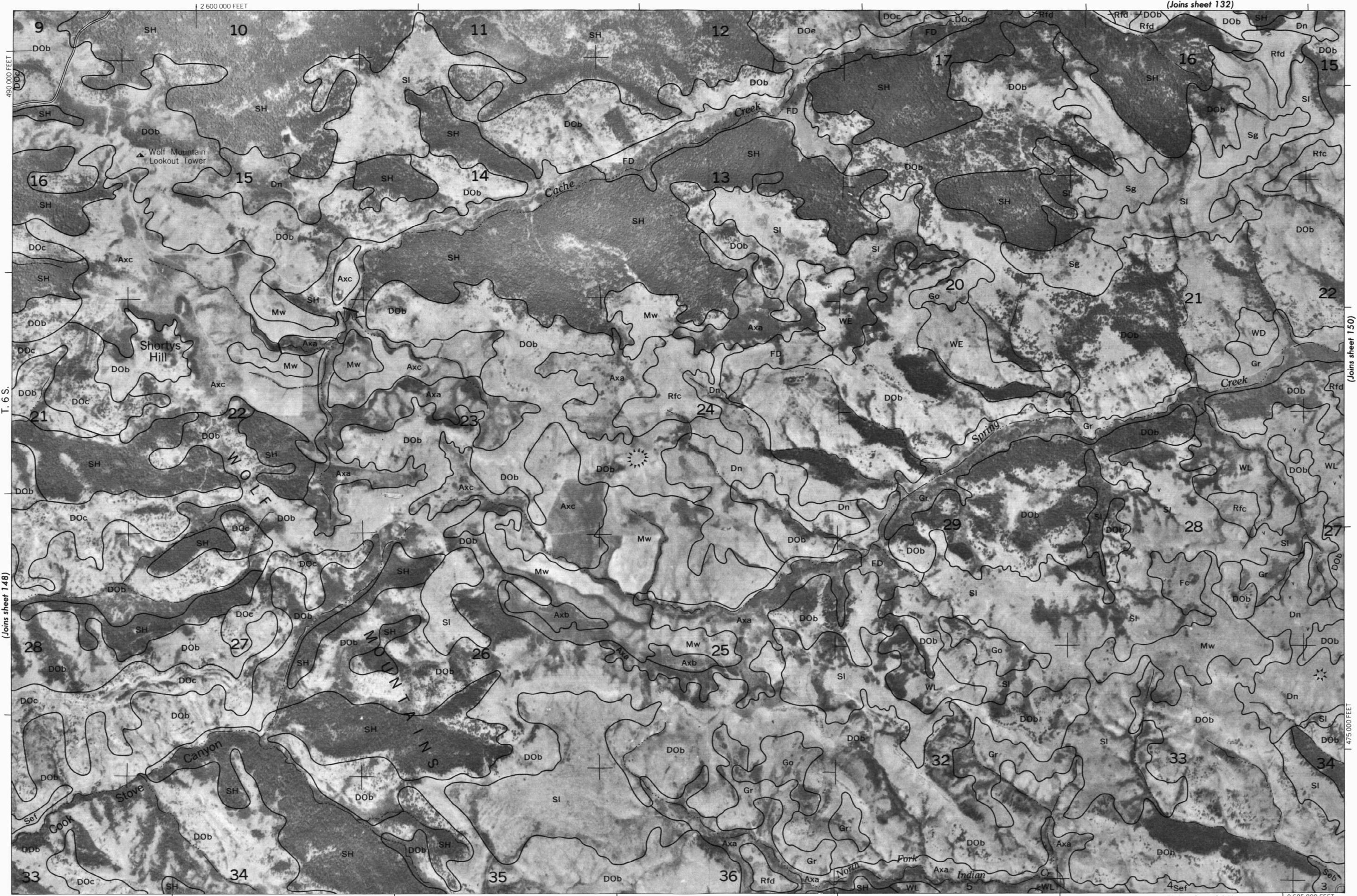


R. 36 E. | R. 37 E



This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.





This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



R. 37 E. | R. 38 E.

(Joins sheet 166)

2 625 000 FEET



190 000 FEET

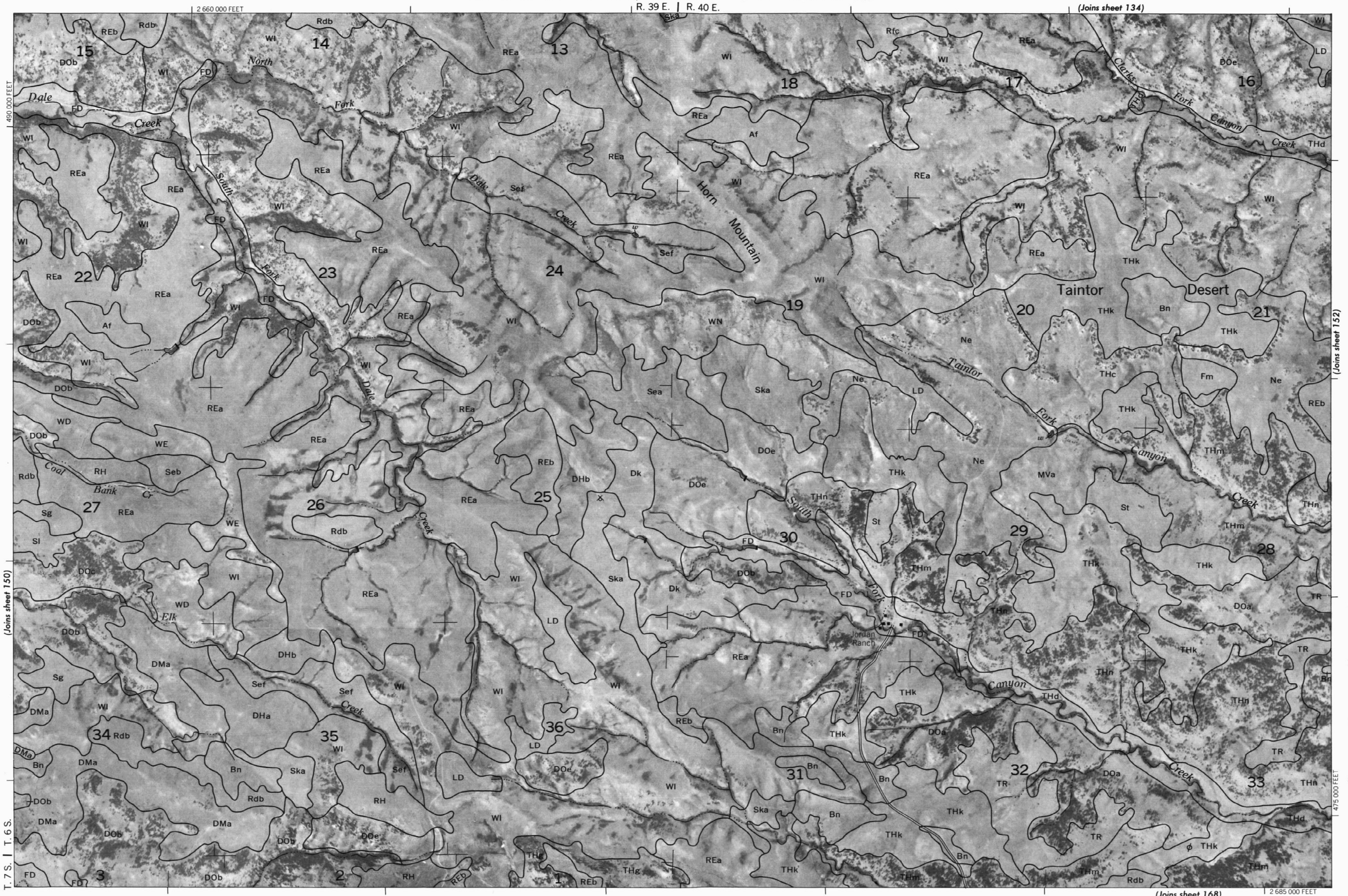
1 475 000 FEET

R. 38 E.	R. 39 E
----------	---------

T 7 S | T 6 S

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.





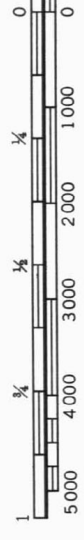
2 660 000 FEET  
480 000 FEET  
(Joins sheet 150)  
T. 7 S. | T. 6 S.

(Joins sheet 134)  
(Joins sheet 152)  
475 000 FEET  
2 685 000 FEET

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



OF \_\_\_\_\_ T. \_\_\_\_\_ S. \_\_\_\_\_  
ROSEBUD COUNTY T. 6 S.

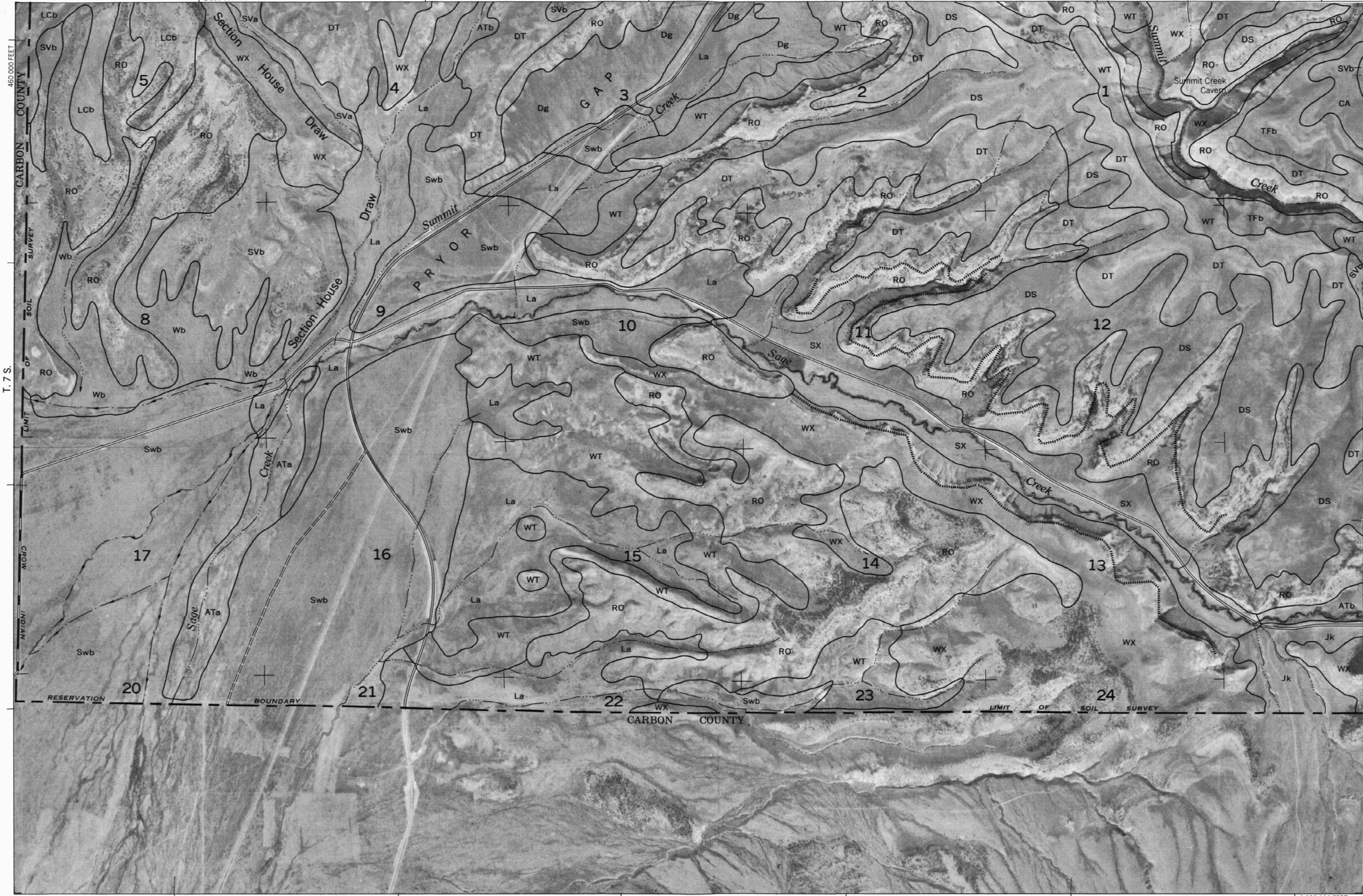


(Joins sheet 169)

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



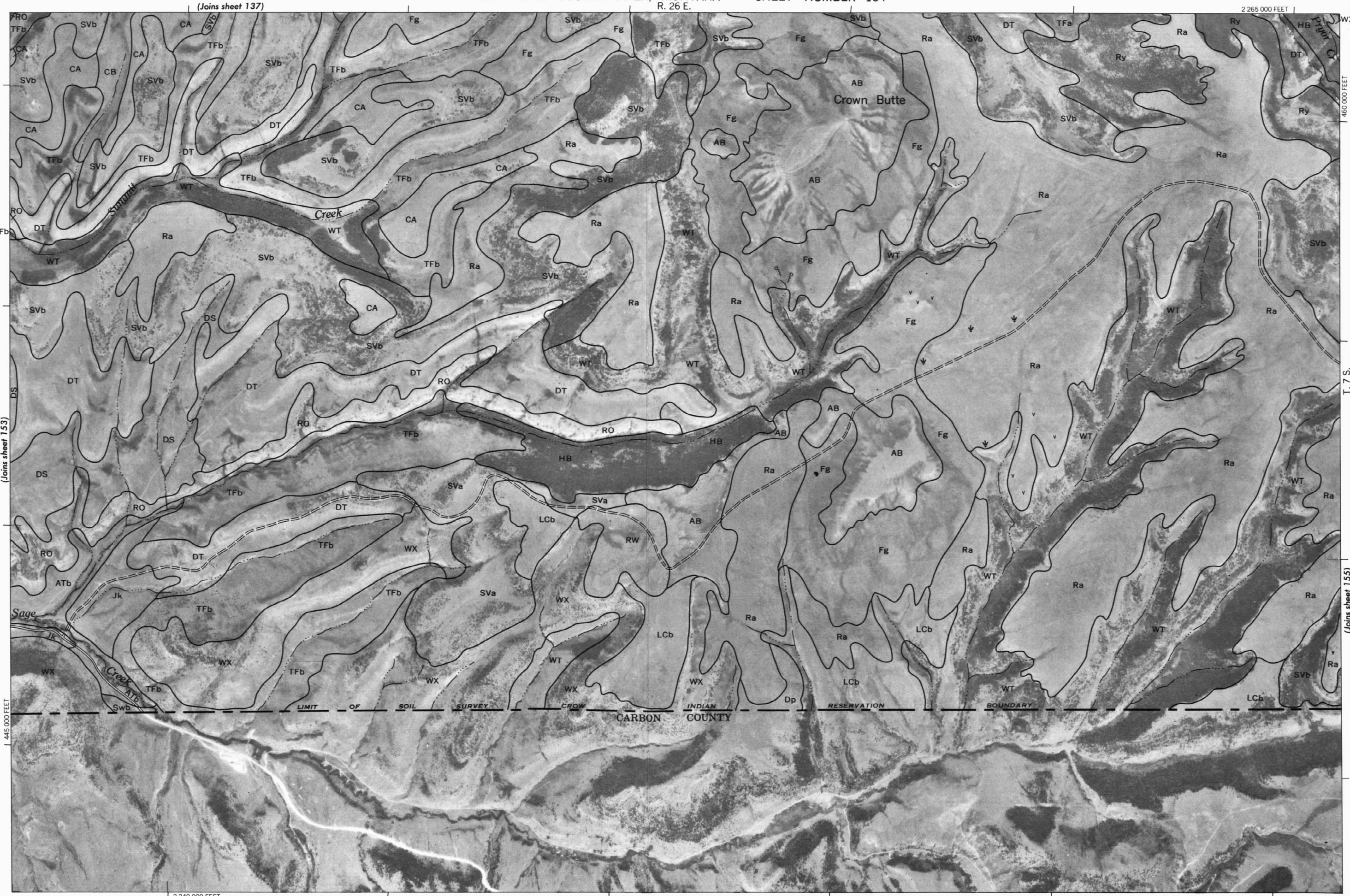
This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



(Joins sheet 154)







This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.









2 Miles  
10 000 Feet

1

5 000

0

0

0

0

0

0

0

0

0

0

0

0

0

0

0

0

0

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0

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0



(Joins sheet 155)

Scale 1:24,000



2 300 000 FEET

460 000 FEET

T. 7 S.

T. 6 S.

(Joins sheet 157)









Scale 1:24,000

T. 7 S. | T. 6 S.

(Joins sheet 157)

445 000 FEET

(Joins sheet 141)

R. 29 E. | R. 30 E.

2 385 000 FEET



2 360 000 FEET

(Joins sheet 171)

(Joins sheet 159)







(Joins sheet 143)

2 445 000 FEET



2 Miles

10 000 Feet

1

5 000

Scale 1:24 000

0

0

1 000

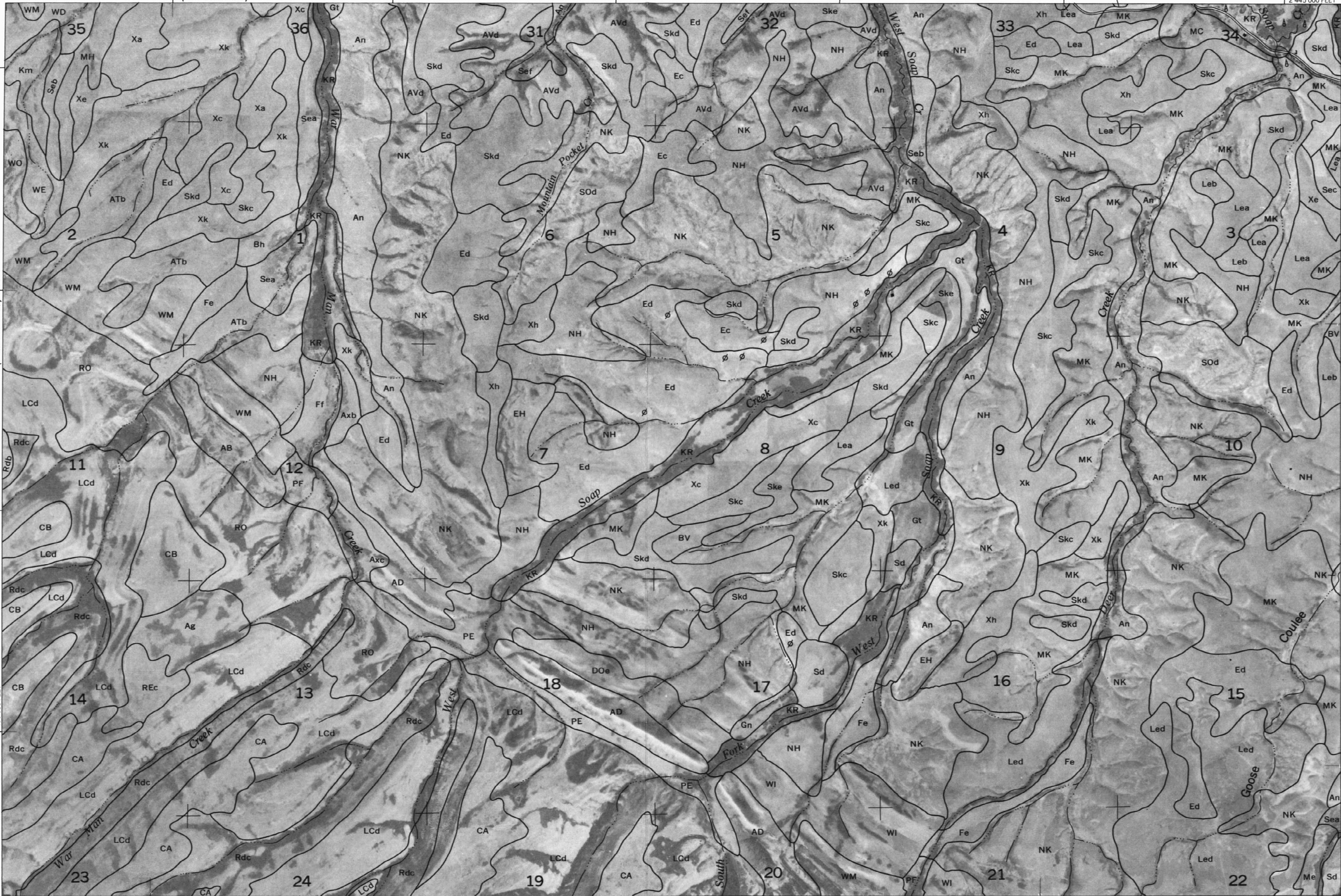
2 000

3 000

4 000

5 000

1 450 000 FEET



2 420 000 FEET

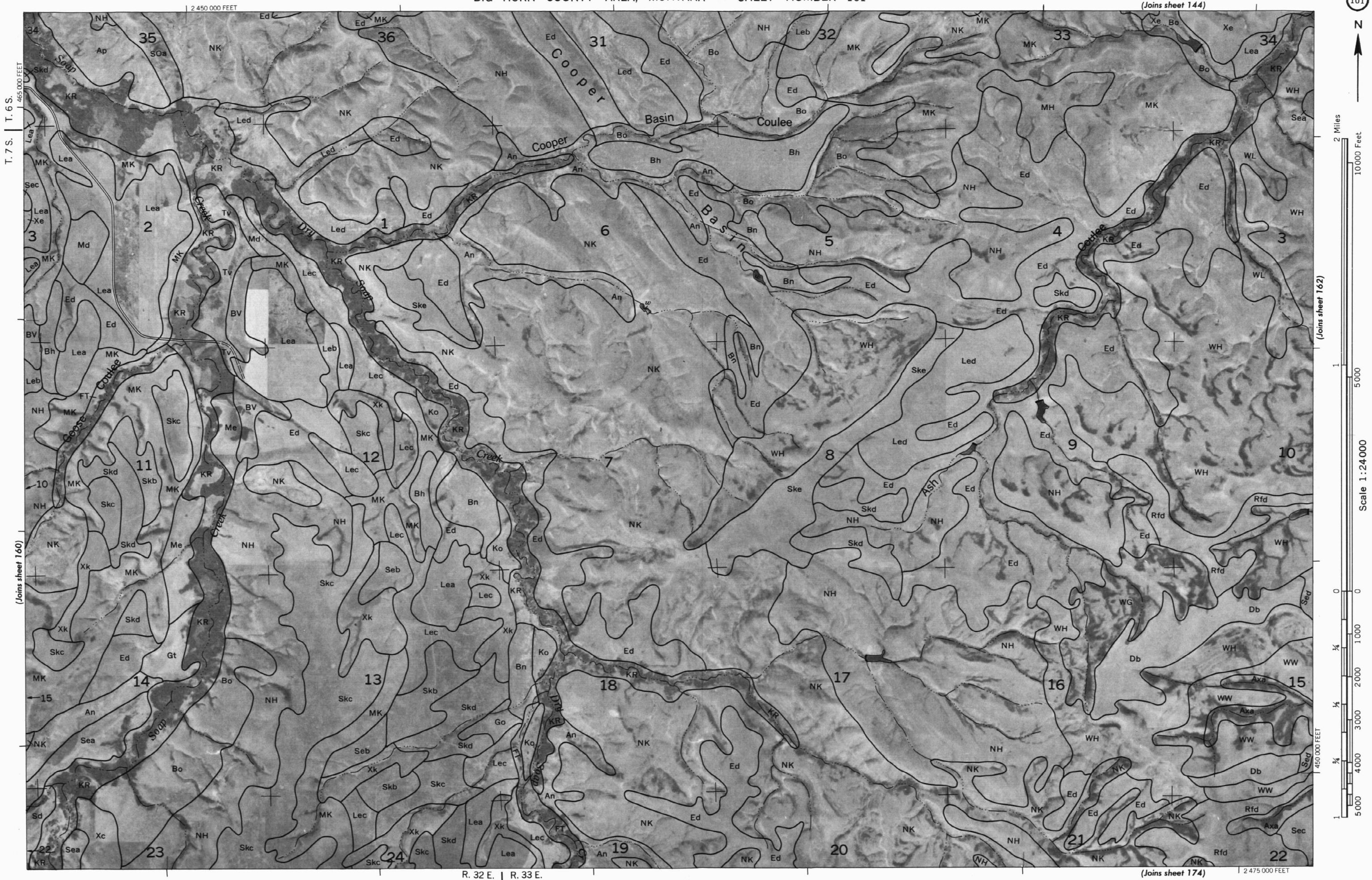
(Joins sheet 173)

R. 31 E. | R. 32 E.

(Joins sheet 161)

T. 7 S. | T. 6 S.



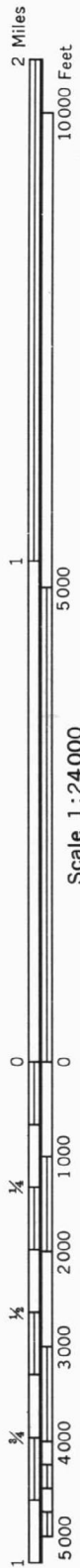


This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(Joins sheet 160)

(Joins sheet 162)

(Joins sheet 174)





(Joins sheet 145)

R. 33 E. | R. 34 E.

2 505 000 FEET



2 Miles

10 000 Feet

1

5000

0

0

0

0

1/4

1000

1/4

2000

1/4

3000

1/4

4000

1

5000

Scale 1:24 000

(Joins sheet 161)

450 000 FEET

2 480 000 FEET

(Joins sheet 175)

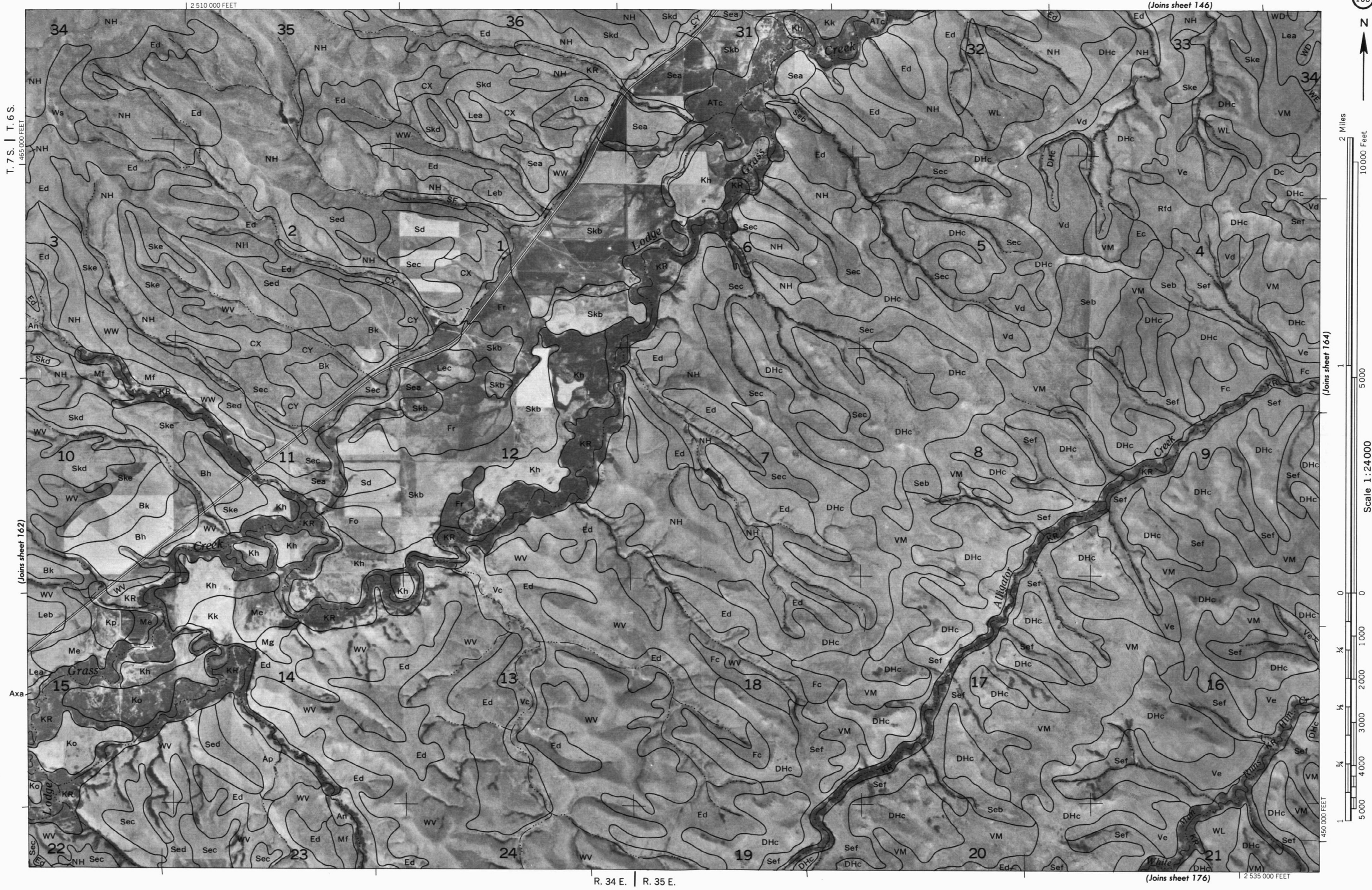
465 000 FEET

(Joins sheet 163)

T. 7 S. | T. 6 S.



This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.  
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



R. 34 E. | R. 35 E.

(Joins sheet 176)

(Joins sheet 164)





5  
6  
7  
8  
9  
10  
11

(continued)

Coordinate grid ticks and land division corners, if shown, are approximately positioned



Scale 1:24000

Sef 2 540 000 FEET (Joins sheet 177)

R. 35 E. | R. 36 E.



(Joins sheet 164)

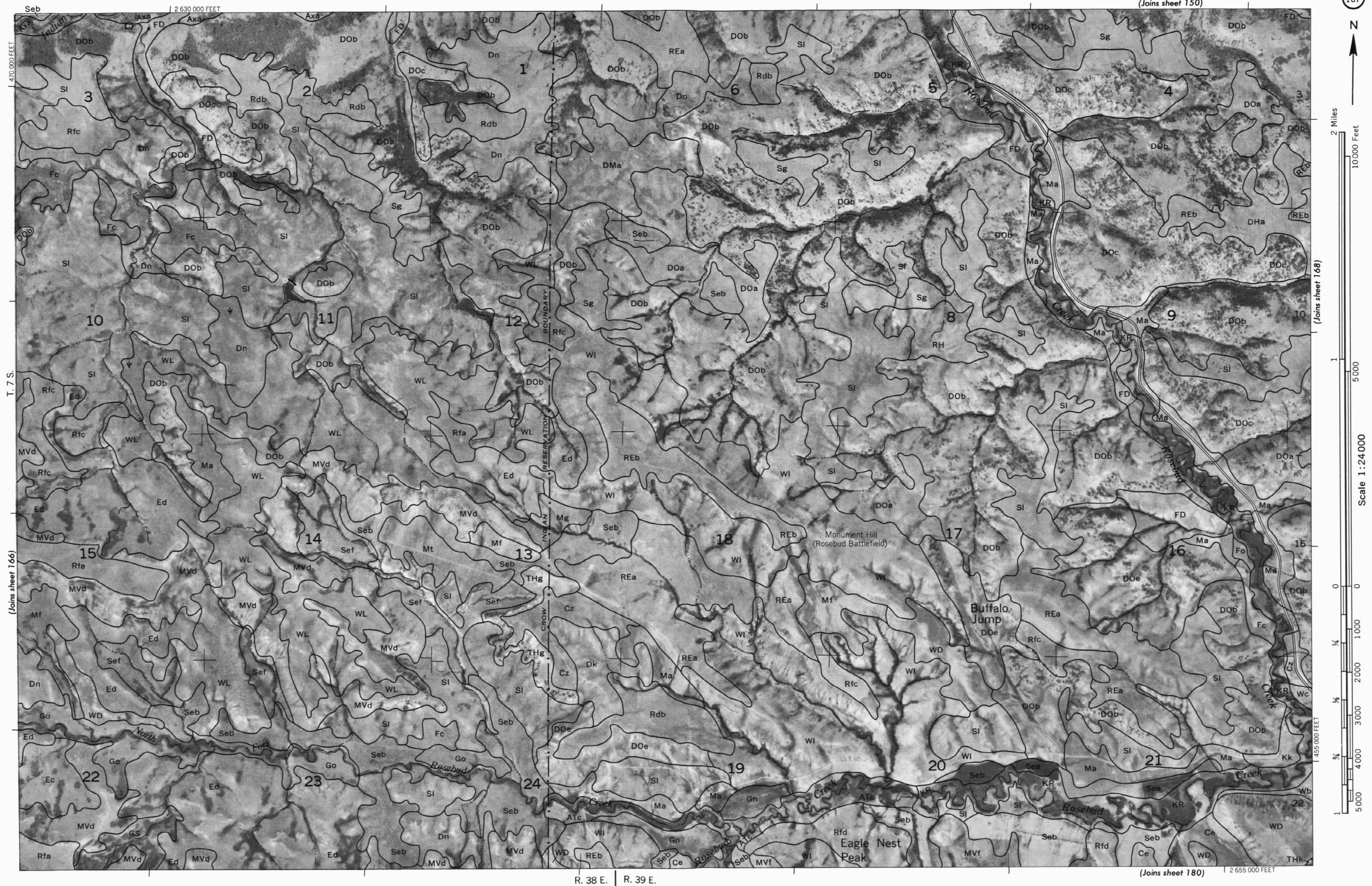
(Joins sheet 178)

2 595 000 FEET















This is a detailed geological map of a region in Rosebud County, Montana. The map displays various soil types, topographic features, and survey boundaries. The soil types are labeled with codes such as THm, THd, THn, THo, DOa, DOb, Wr, Nd, St, THk, LD, SU, Wp, Wb, Cf, Wd, and Td. Topographic features include South Fork Canyon, Fourmile Creek, Barber Draw, and several numbered areas (1, 2, 3, 4, 9, 10, 11, 12, 13, 14, 15, 16, 21, 22, 23, 24). The map is oriented with North at the top and includes a scale bar at the bottom indicating distances in feet (0 to 2,715,000 feet). The map is bordered by T. 7 S. on the left, R. 40 E. on the top, and (Joins sheet 182) on the bottom. A vertical dashed line on the right side is labeled 'LIMIT of ROSEBUD COUNTY'.





2 Miles  
10000 Feet

1 5000

0 0

1/4 1000

1/4 2000

1/4 3000

1/4 4000

1/4 5000

1/4 425 000 FEET

1/4 2 320 000 FEET

1/4 2 330 000 FEET

1/4 2 340 000 FEET

1/4 2 350 000 FEET

1/4 2 360 000 FEET

1/4 2 370 000 FEET

1/4 2 380 000 FEET

1/4 2 390 000 FEET

1/4 2 400 000 FEET

1/4 2 410 000 FEET

1/4 2 420 000 FEET

1/4 2 430 000 FEET

1/4 2 440 000 FEET

1/4 2 450 000 FEET

1/4 2 460 000 FEET

1/4 2 470 000 FEET

1/4 2 480 000 FEET

1/4 2 490 000 FEET

1/4 2 500 000 FEET

1/4 2 510 000 FEET

1/4 2 520 000 FEET

1/4 2 530 000 FEET

1/4 2 540 000 FEET

1/4 2 550 000 FEET

1/4 2 560 000 FEET

1/4 2 570 000 FEET

1/4 2 580 000 FEET

1/4 2 590 000 FEET

1/4 2 600 000 FEET

1/4 2 610 000 FEET

1/4 2 620 000 FEET

1/4 2 630 000 FEET

1/4 2 640 000 FEET

1/4 2 650 000 FEET

1/4 2 660 000 FEET

1/4 2 670 000 FEET

1/4 2 680 000 FEET

1/4 2 690 000 FEET

1/4 2 700 000 FEET

1/4 2 710 000 FEET

1/4 2 720 000 FEET

1/4 2 730 000 FEET

1/4 2 740 000 FEET

1/4 2 750 000 FEET

1/4 2 760 000 FEET

1/4 2 770 000 FEET

1/4 2 780 000 FEET

1/4 2 790 000 FEET

1/4 2 800 000 FEET

1/4 2 810 000 FEET

1/4 2 820 000 FEET

1/4 2 830 000 FEET

1/4 2 840 000 FEET

1/4 2 850 000 FEET

1/4 2 860 000 FEET

1/4 2 870 000 FEET

1/4 2 880 000 FEET

1/4 2 890 000 FEET

1/4 2 900 000 FEET

1/4 2 910 000 FEET

1/4 2 920 000 FEET

1/4 2 930 000 FEET

1/4 2 940 000 FEET

1/4 2 950 000 FEET

1/4 2 960 000 FEET

1/4 2 970 000 FEET

1/4 2 980 000 FEET

1/4 2 990 000 FEET

1/4 3 000 000 FEET

1/4 3 010 000 FEET

1/4 3 020 000 FEET

1/4 3 030 000 FEET

1/4 3 040 000 FEET

1/4 3 050 000 FEET

1/4 3 060 000 FEET

1/4 3 070 000 FEET

1/4 3 080 000 FEET

1/4 3 090 000 FEET

1/4 3 100 000 FEET

1/4 3 110 000 FEET

1/4 3 120 000 FEET

1/4 3 130 000 FEET

1/4 3 140 000 FEET

1/4 3 150 000 FEET

1/4 3 160 000 FEET

1/4 3 170 000 FEET

1/4 3 180 000 FEET

1/4 3 190 000 FEET

1/4 3 200 000 FEET

1/4 3 210 000 FEET

1/4 3 220 000 FEET

1/4 3 230 000 FEET

1/4 3 240 000 FEET

1/4 3 250 000 FEET

1/4 3 260 000 FEET

1/4 3 270 000 FEET

1/4 3 280 000 FEET

1/4 3 290 000 FEET

1/4 3 300 000 FEET

1/4 3 310 000 FEET

1/4 3 320 000 FEET

1/4 3 330 000 FEET

1/4 3 340 000 FEET

1/4 3 350 000 FEET

1/4 3 360 000 FEET

1/4 3 370 000 FEET

1/4 3 380 000 FEET

1/4 3 390 000 FEET

1/4 3 400 000 FEET

1/4 3 410 000 FEET

1/4 3 420 000 FEET

1/4 3 430 000 FEET

1/4 3 440 000 FEET

1/4 3 450 000 FEET

1/4 3 460 000 FEET

1/4 3 470 000 FEET

1/4 3 480 000 FEET

1/4 3 490 000 FEET

1/4 3 500 000 FEET

1/4 3 510 000 FEET

1/4 3 520 000 FEET

1/4 3 530 000 FEET

1/4 3 540 000 FEET

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1/4 3 560 000 FEET

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1/4 3 640 000 FEET

1/4 3 650 000 FEET

1/4 3 660 000 FEET

1/4 3 670 000 FEET

1/4 3 680 000 FEET

1/4 3 690 000 FEET

1/4 3 700 000 FEET

1/4 3 710 000 FEET

1/4 3 720 000 FEET

1/4 3 730 000 FEET

1/4 3 740 000 FEET

1/4 3 750 000 FEET

1/4 3 760 000 FEET

1/4 3 770 000 FEET

1/4 3 780 000 FEET

1/4 3 790 000 FEET

1/4 3 800 000 FEET

1/4 3 810 000 FEET

1/4 3 820 000 FEET

1/4 3 830 000 FEET

1/4 3 840 000 FEET

1/4 3 850 000 FEET

1/4 3 860 000 FEET

1/4 3 870 000 FEET

1/4 3 880 000 FEET

1/4 3 890 000 FEET

1/4 3 900 000 FEET

1/4 3 910 000 FEET

1/4 3 920 000 FEET

1/4 3 930 000 FEET

1/4 3 940 000 FEET

1/4 3 950 000 FEET

1/4 3 960 000 FEET

1/4 3 970 000 FEET

1/4 3 980 000 FEET

1/4 3 990 000 FEET

1/4 4 000 000 FEET

1/4 4 010 000 FEET

1/4 4 020 000 FEET

1/4 4 030 000 FEET

1/4 4 040 000 FEET

1/4 4 050 000 FEET

1/4 4 060 000 FEET

1/4 4 070 000 FEET

1/4 4 080 000 FEET

1/4 4 090 000 FEET

1/4 4 100 000 FEET

1/4 4 110 000 FEET

1/4 4 120 000 FEET

1/4 4 130 000 FEET

1/4 4 140 000 FEET

1/4 4 150 000 FEET

1/4 4 160 000 FEET

1/4 4 170 000 FEET

1/4 4 180 000 FEET

1/4 4 190 000 FEET

1/4 4 200 000 FEET

1/4 4 210 000 FEET

1/4 4 220 000 FEET

1/4 4 230 000 FEET

1/4 4 240 000 FEET

1/4 4 250 000 FEET

1/4 4 260 000 FEET

1/4 4 270 000 FEET

1/4 4 280 000 FEET

1/4 4 290 000 FEET

1/4 4 300 000 FEET

1/4 4 310 000 FEET

1/4 4 320 000 FEET

1/4 4 330 000 FEET

1/4 4 340 000 FEET

1/4 4 350 000 FEET

1/4 4 360 000 FEET

1/4 4 370 000 FEET

1/4 4 380 000 FEET

1/4 4 390 000 FEET

1/4 4 400 000 FEET

1/4 4 410 000 FEET

1/4 4 420 000 FEET

1/4 4 430 000 FEET

1/4 4 440 000 FEET

1/4 4 450 000 FEET

1/4 4 460 000 FEET

1/4 4 470 000 FEET

1/4 4 480 000 FEET

1/4 4 490 000 FEET

1/4 4 500 000 FEET

1/4 4 510 000 FEET

1/4 4 520 000 FEET

1/4 4 530 000 FEET

1/4 4 540 000 FEET

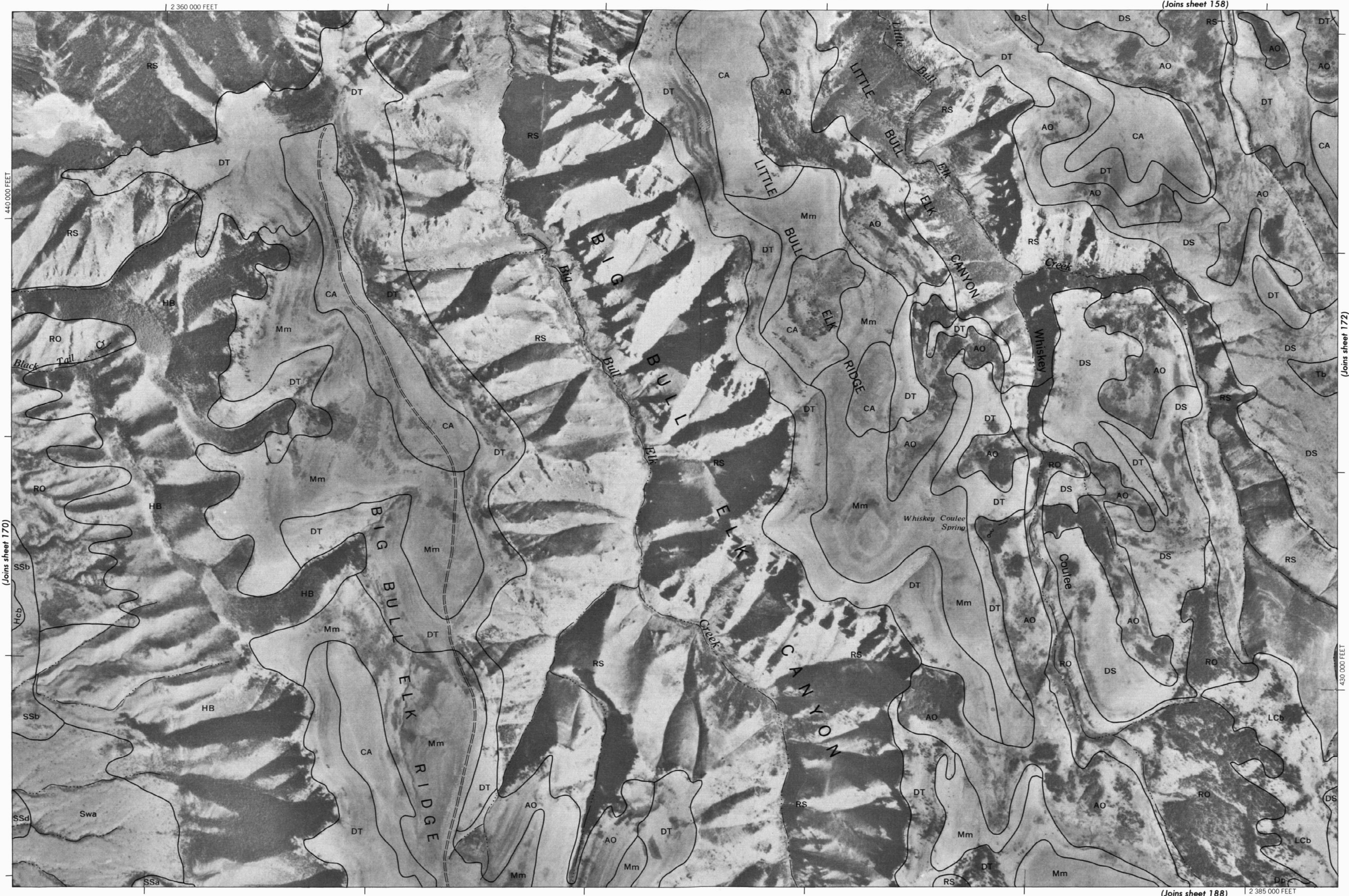
1/4 4 550 000 FEET

1/4 4 560 000 FEET

1/4 4 570 000 FEET

1/4 4 580 000 FEET





This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(Joins sheet 158)

N

2 Miles

10000 Feet

1

5000

Scale 1:24 000

430 000 FEET

0 1000 2000 3000 4000 5000

1/4 1/2 3/4

(Joins sheet 172)

(Joins sheet 178)

2 385 000 FEET



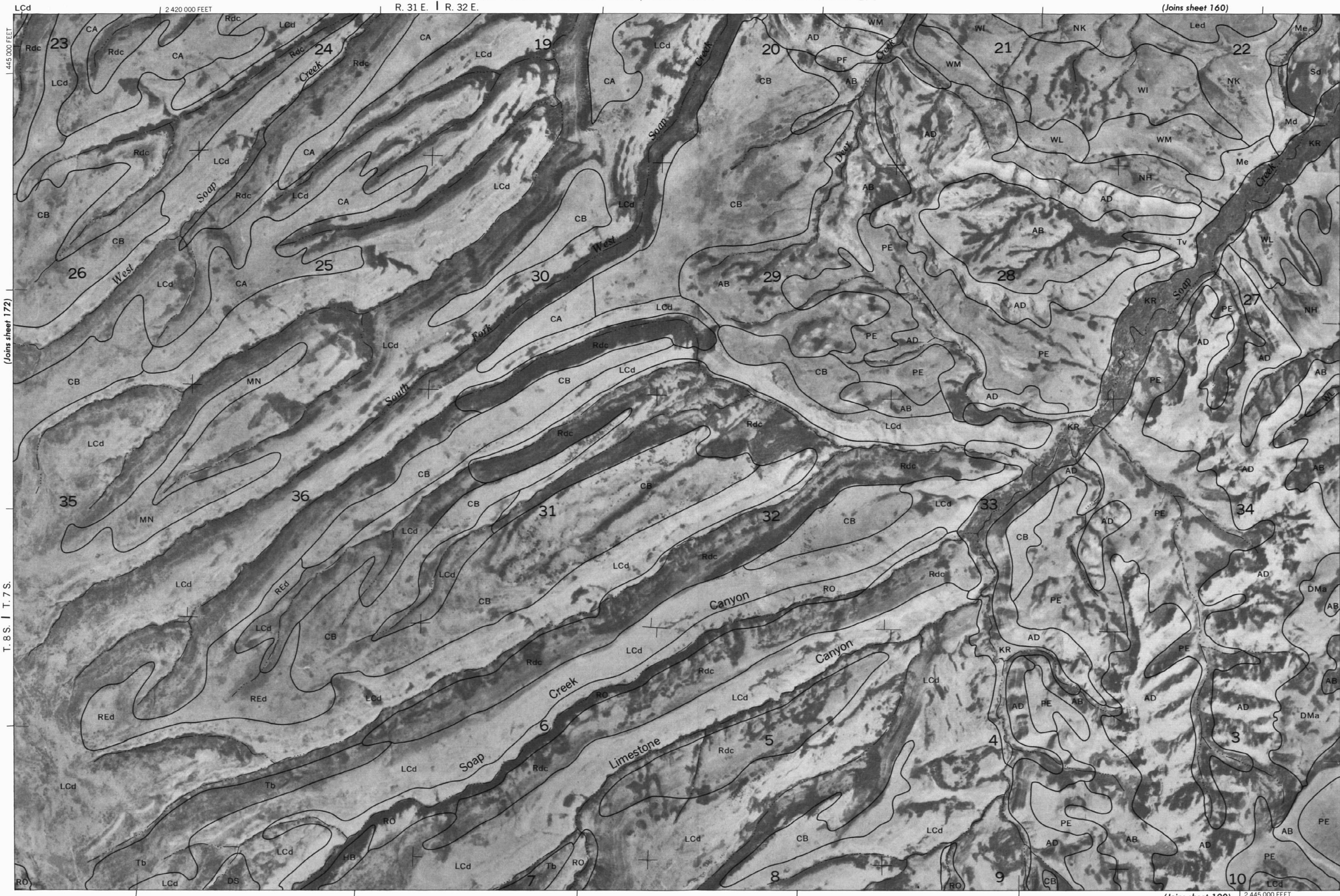
(Joins sheet 189)

T. 8S. | T. 7S.

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.







R. 31 E. | R. 32 E.

(Joins sheet 160)

LCd | 2 420 000 FEET

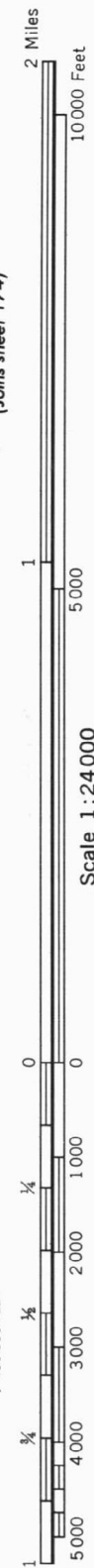
(Joins sheet 190) | 2 445 000 FEET

(Joins sheet 172)

(Joins sheet 174)

T. 8 S. | T. 7 S.

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

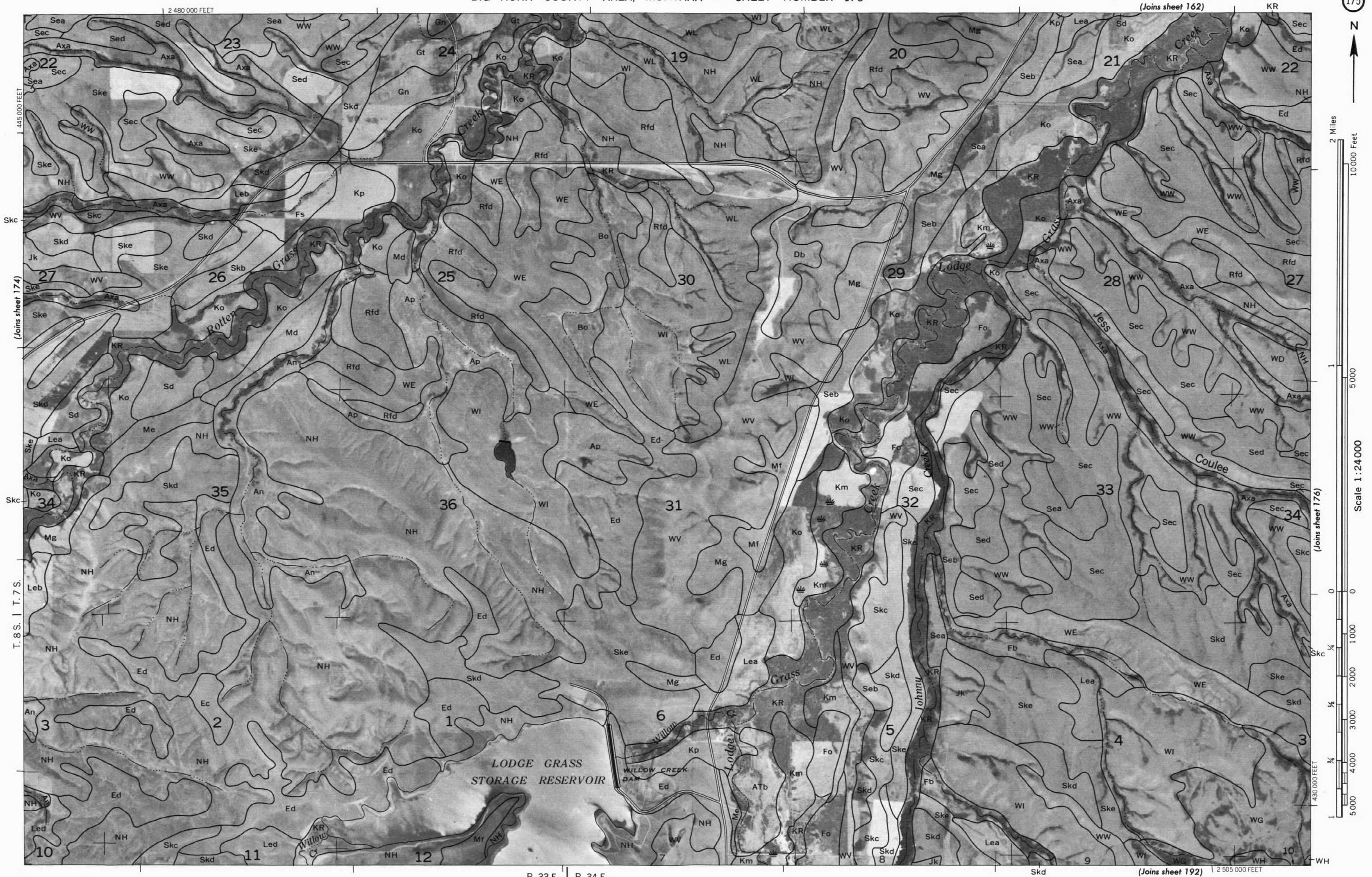








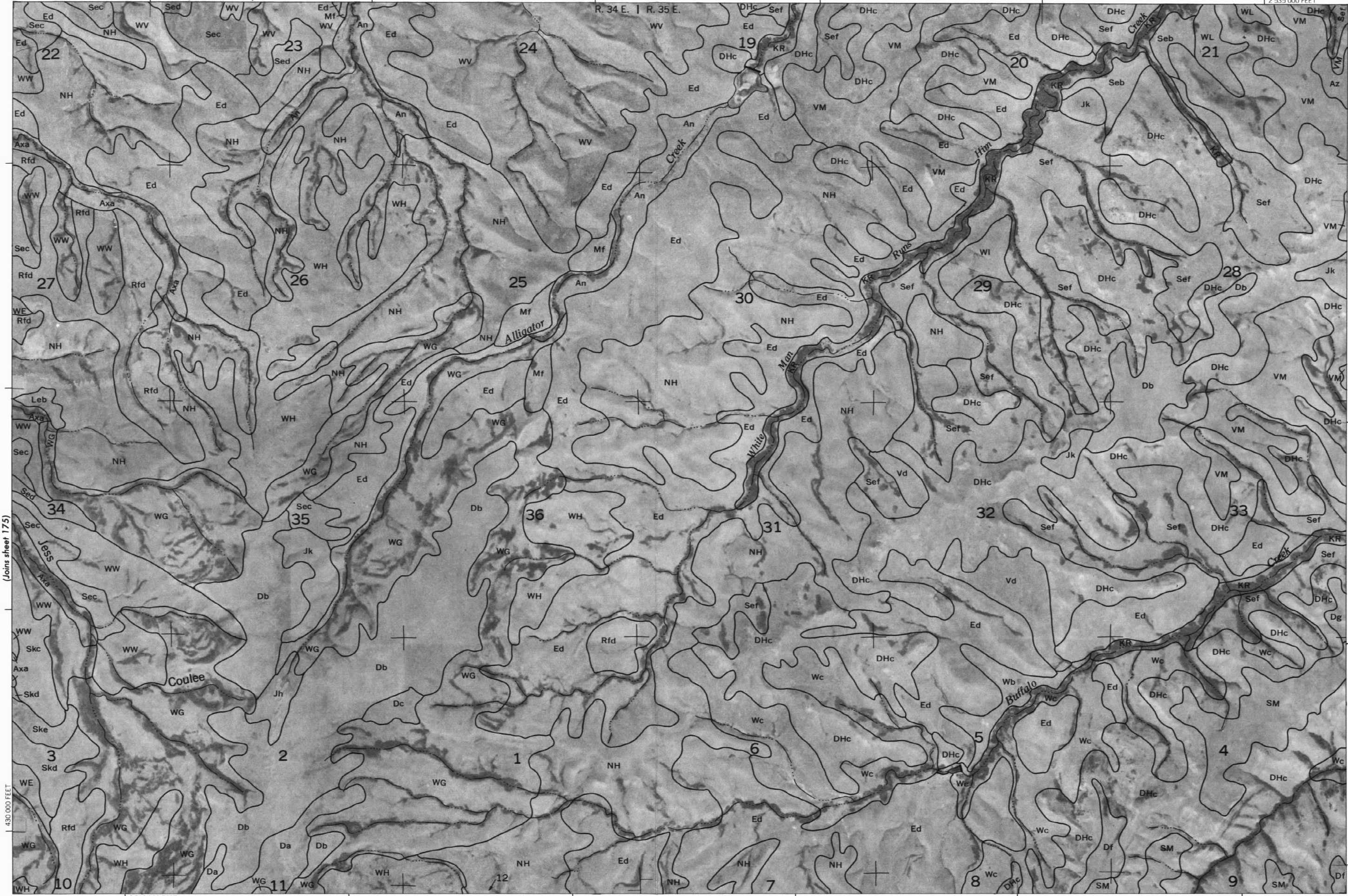
R. 33 E.	R. 34 E.
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(Joins sheet 163)

2 535 000 FEET



2 510 000 FEET

(Joins sheet 193)

(Joins sheet 177)

T. 8 S. | T. 7 S.

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



T. 8 S. | T. 7 S.



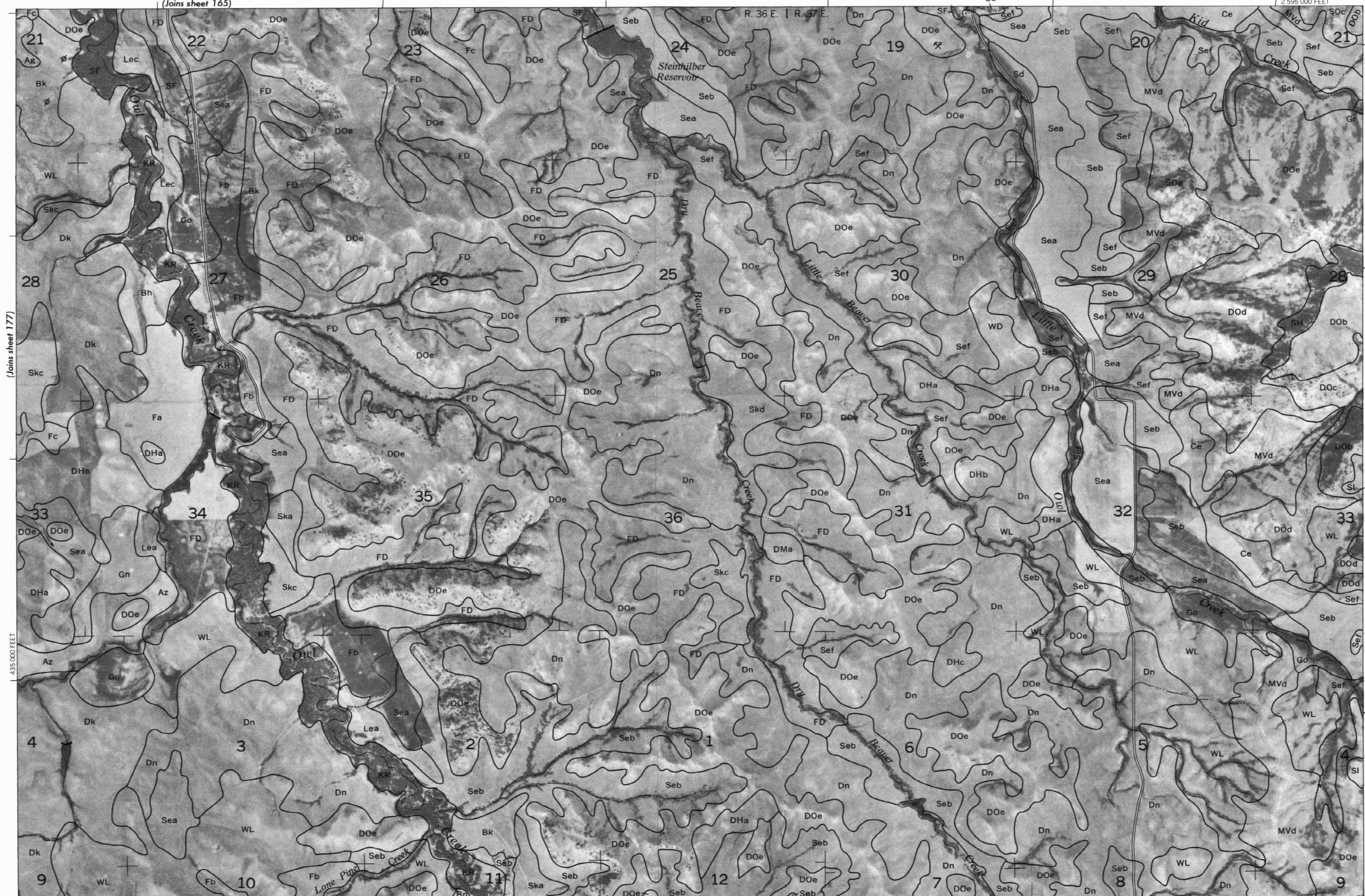
Scale 1:24 000



(Joins sheet 179)

T 8 S	T 7 S
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This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Contour lines and land division corners, if shown, are approximately positioned.









(Joins sheet 167)

2 655 000 FEET



Scale 1:24 000

(Joins sheet 179)

435 000 FEET

2 630 000 FEET

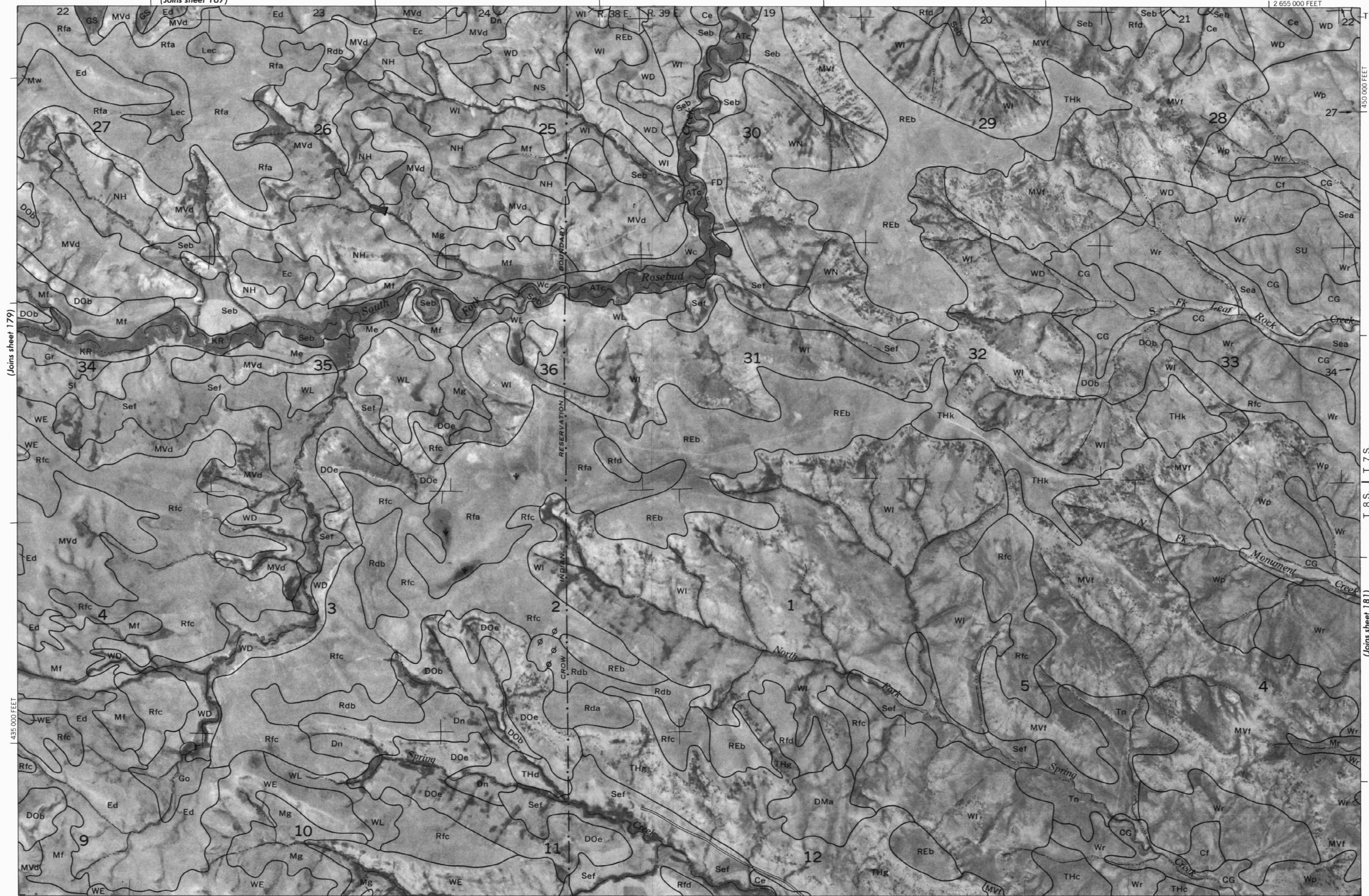
(Joins sheet 197)

R. 38 E. | R. 39 E.

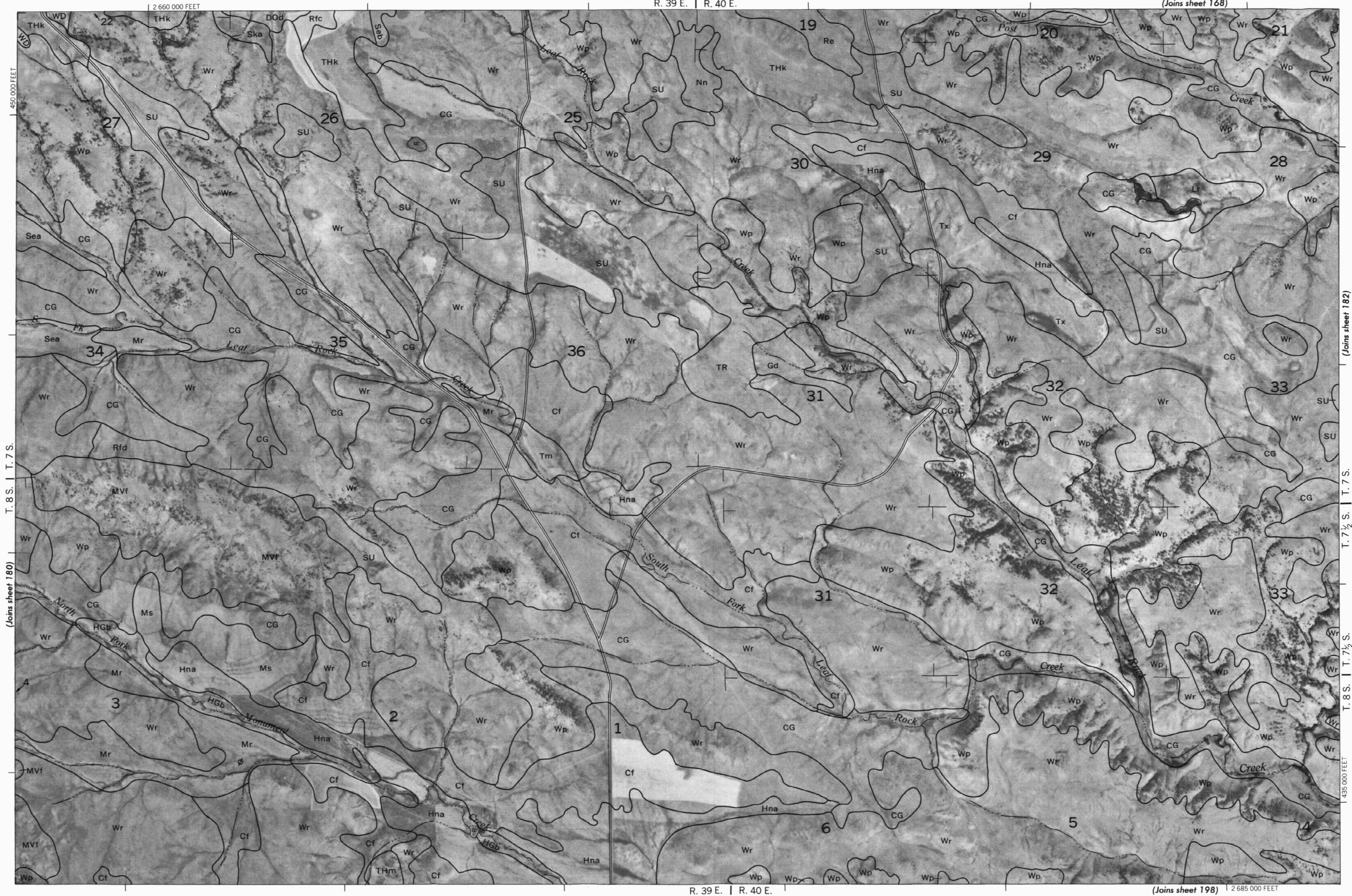
T. 8 S. | T. 7 S.

(Joins sheet 181)

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.







This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.  
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(Joins sheet 180) | T. 8 S. | T. 7.5 S.

(Joins sheet 182)

T. 8 S. | T. 7.5 S.

435 000 FEET

R. 39 E. | R. 40 E.

(Joins sheet 198) | 2 685 000 FEET







2 Miles  
10 000 Feet

Scale 1:24 000  
T. 7½ S. | T. 7 S.  
T. 8 S. | T. 7½ S.  
435 000 FEET  
2 690 000 FEET



450 000 FEET

T. 8 S. | T. 7½ S.

(Joins sheet 183)



A scale bar consisting of two horizontal lines. The top line is longer and labeled "2 Miles". The bottom line is shorter and labeled "10,000 Feet".

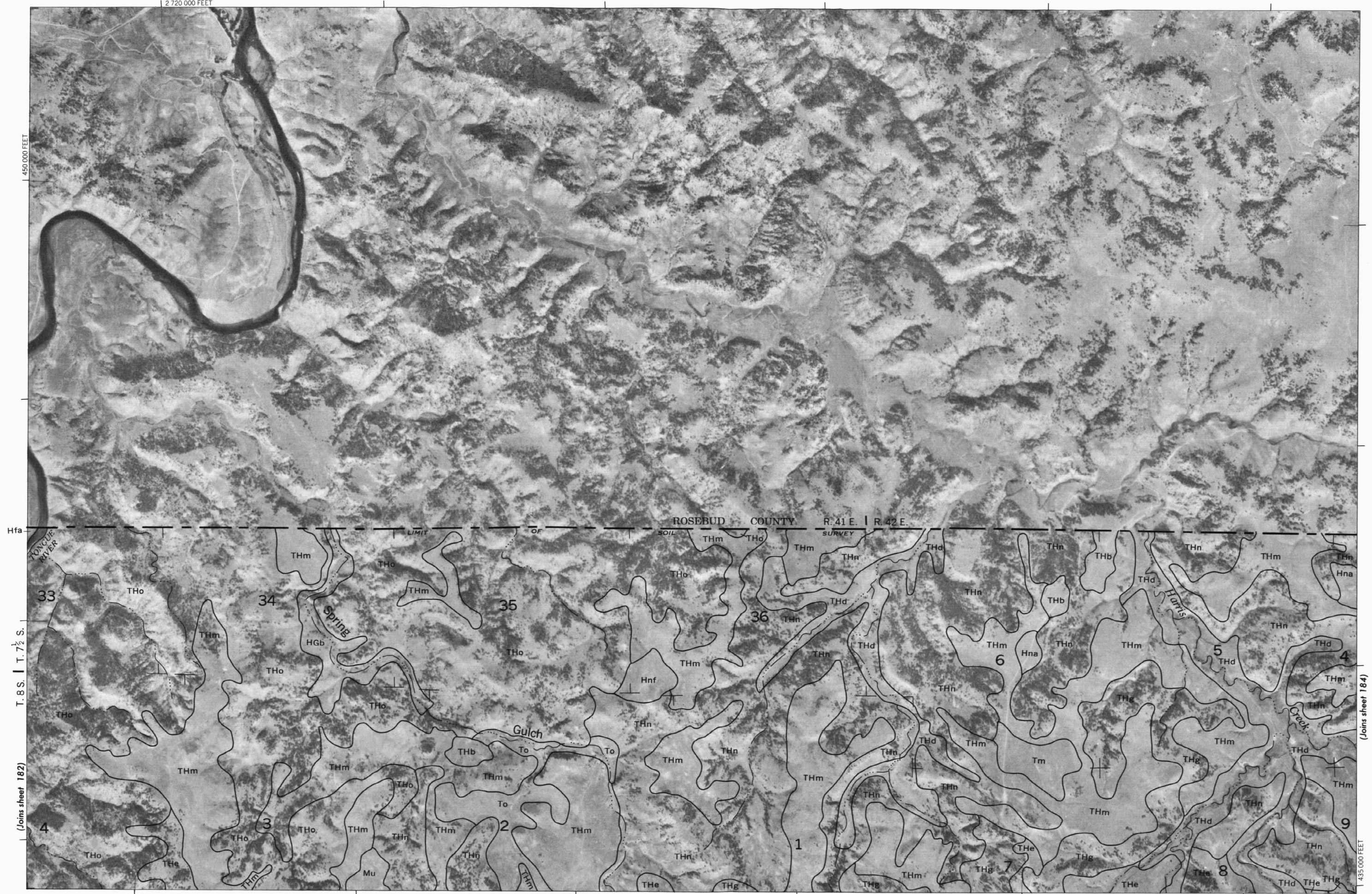
Scale 1:24 000

—

R. 41 E. | R. 42 E.

(Joins sheet 182)

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.







2 Miles

10000 Feet

1

5000

Scale 1:24000

0

1000

2000

3000

4000

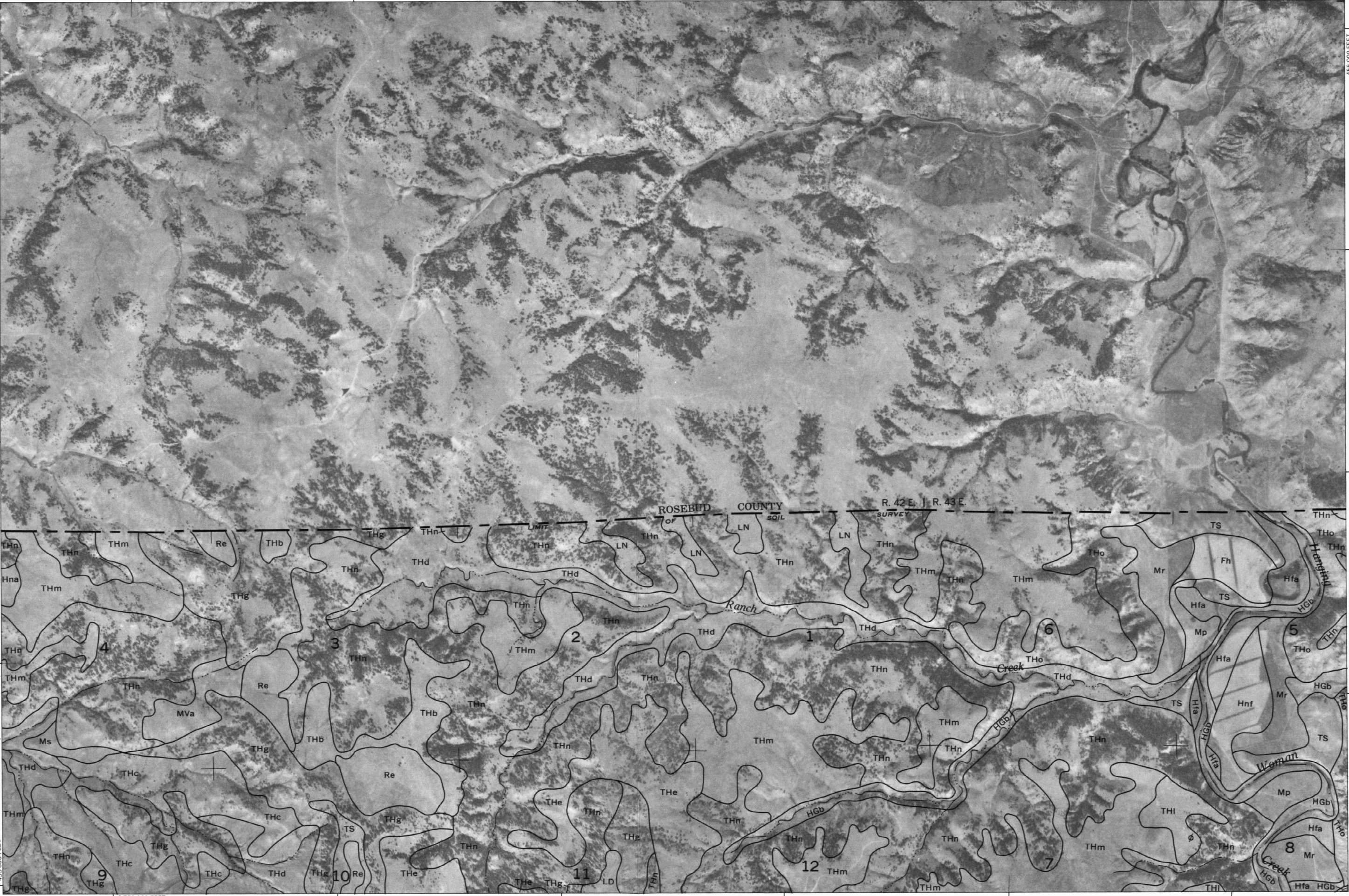
5000

(Joins sheet 183)

435 000 FEET

2 750 000 FEET

(Joins sheet 201)



(Joins sheet 185)

455 000 FEET

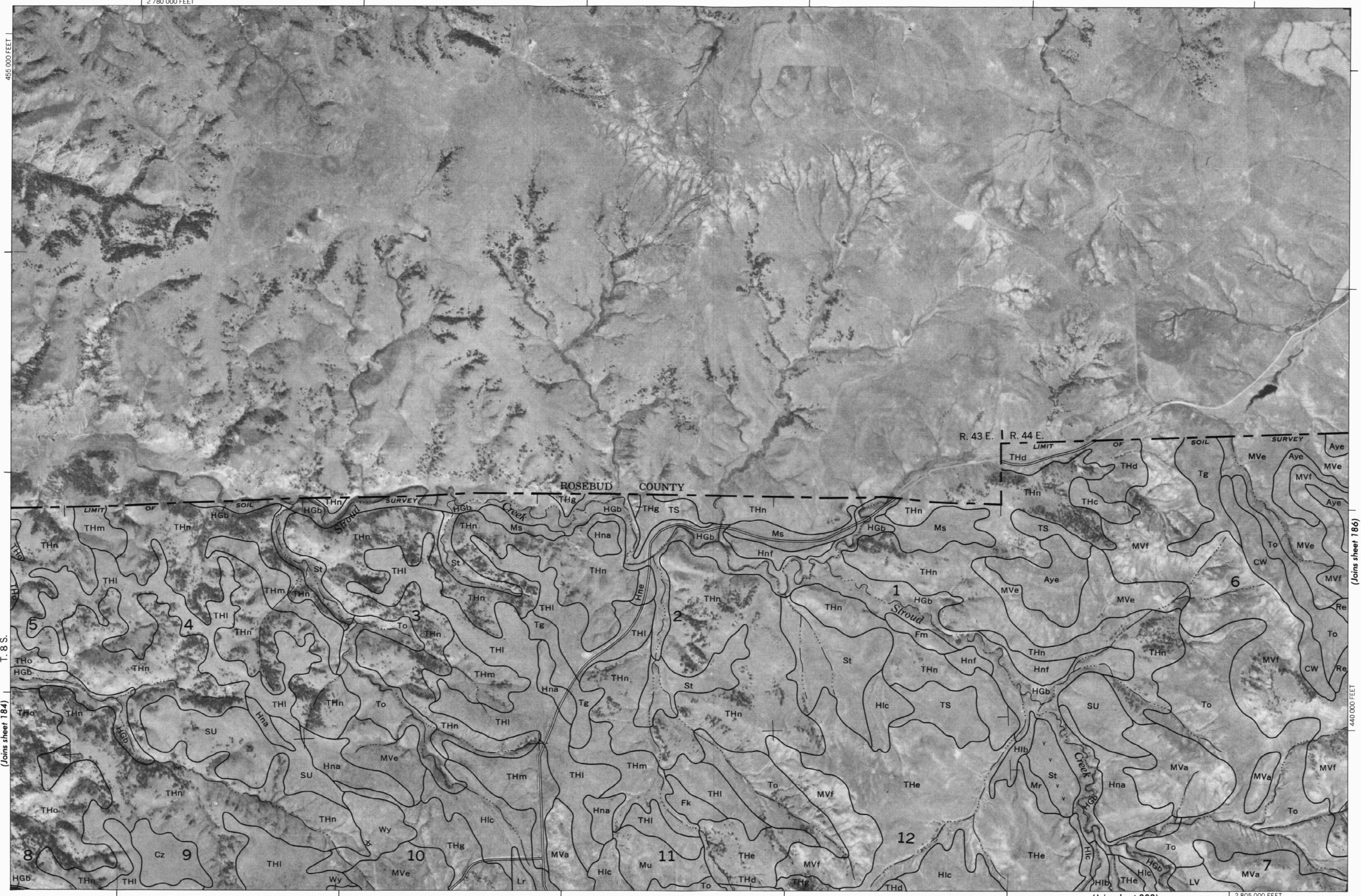


Distance from water (m)	Species 1 (%)	Species 2 (%)	Species 3 (%)
1	~10	~10	~10
500	~10	~10	~10
3000	~10	~10	~10
2000	~10	~10	~10

2 805 000 FEET

400 000 FEET

440 000 FEET







2 Miles

10 000 Feet

5 000

0

1 000

2 000

3 000

4 000

5 000

6 000

7 000

8 000

9 000

10 000

11 000

12 000

13 000

14 000

15 000

16 000

17 000

18 000

19 000

20 000

21 000

22 000

23 000

24 000

Scale 1:24 000

(Joins sheet 185)

440 000 FEET

2 810 000 FEET

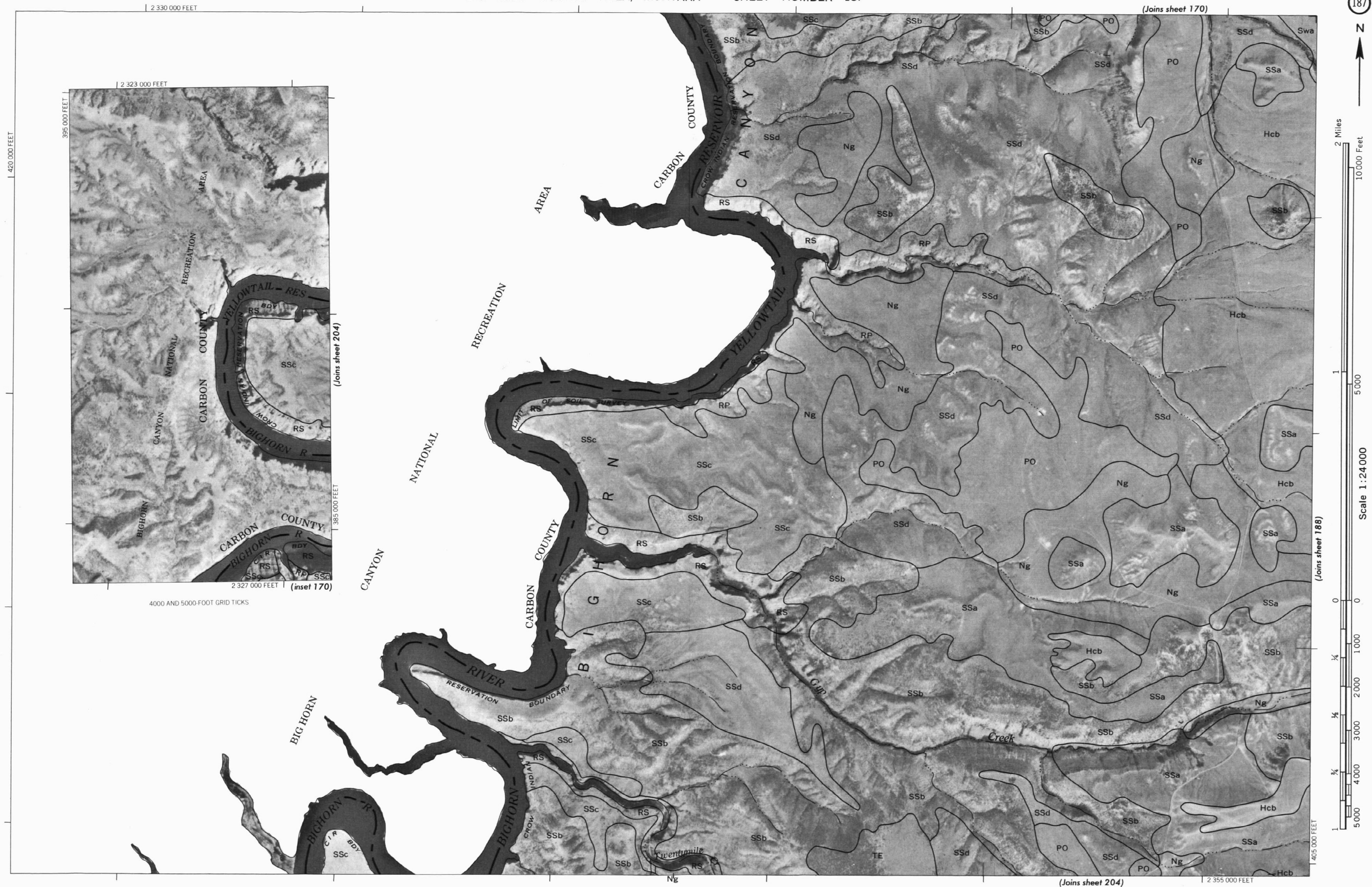
(Joins sheet 203)

455 000 FEET





This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.







2 Miles  
10 000 Feet

1  
5 000

Scale 1:24 000

0 0 1 000 2 000 3 000 4 000 5 000  
1/4 1/2 3/4

(Joins sheet 187)

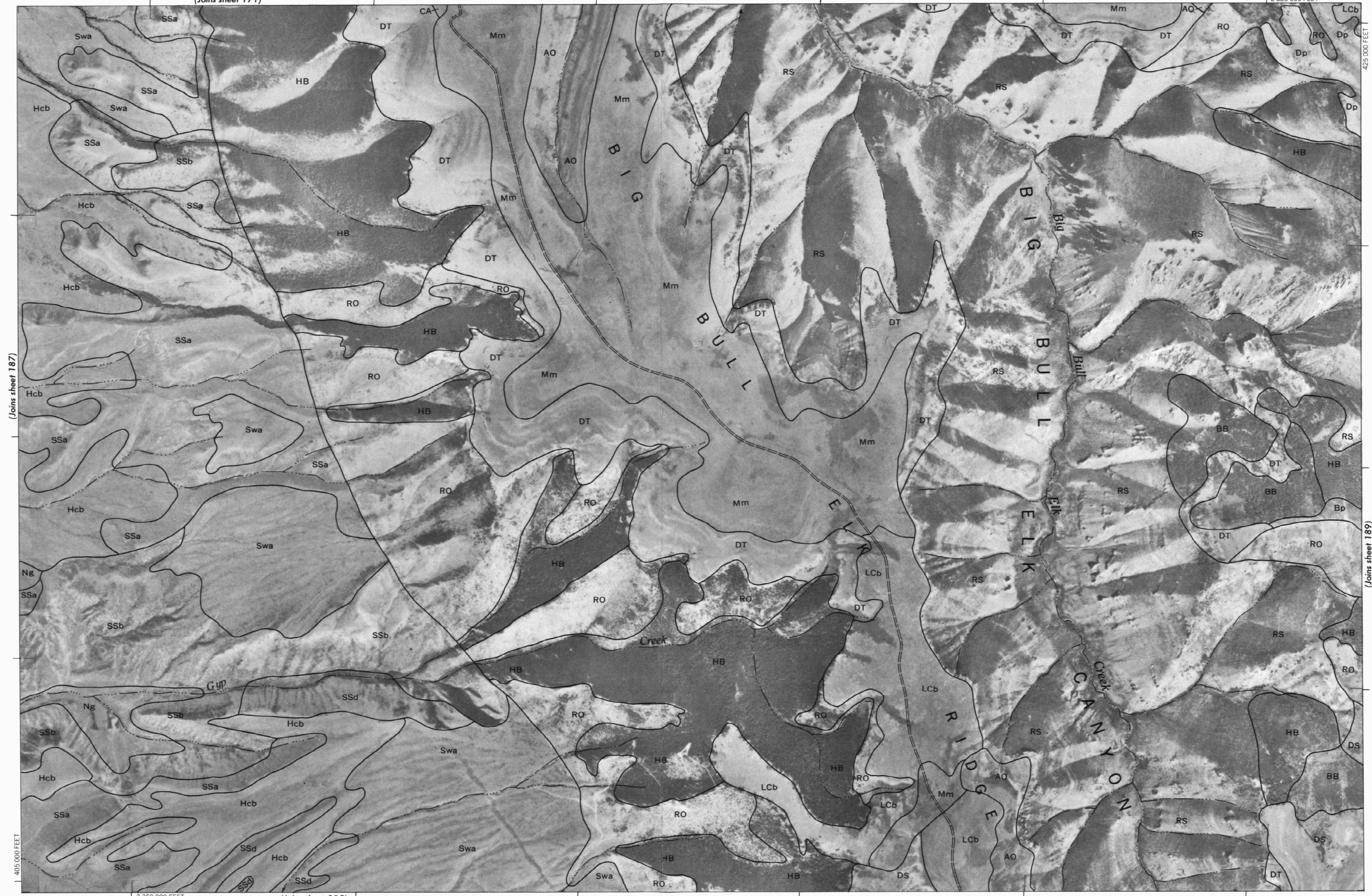
405 000 FEET

2 360 000 FEET

(Joins sheet 205)

(Joins sheet 189)

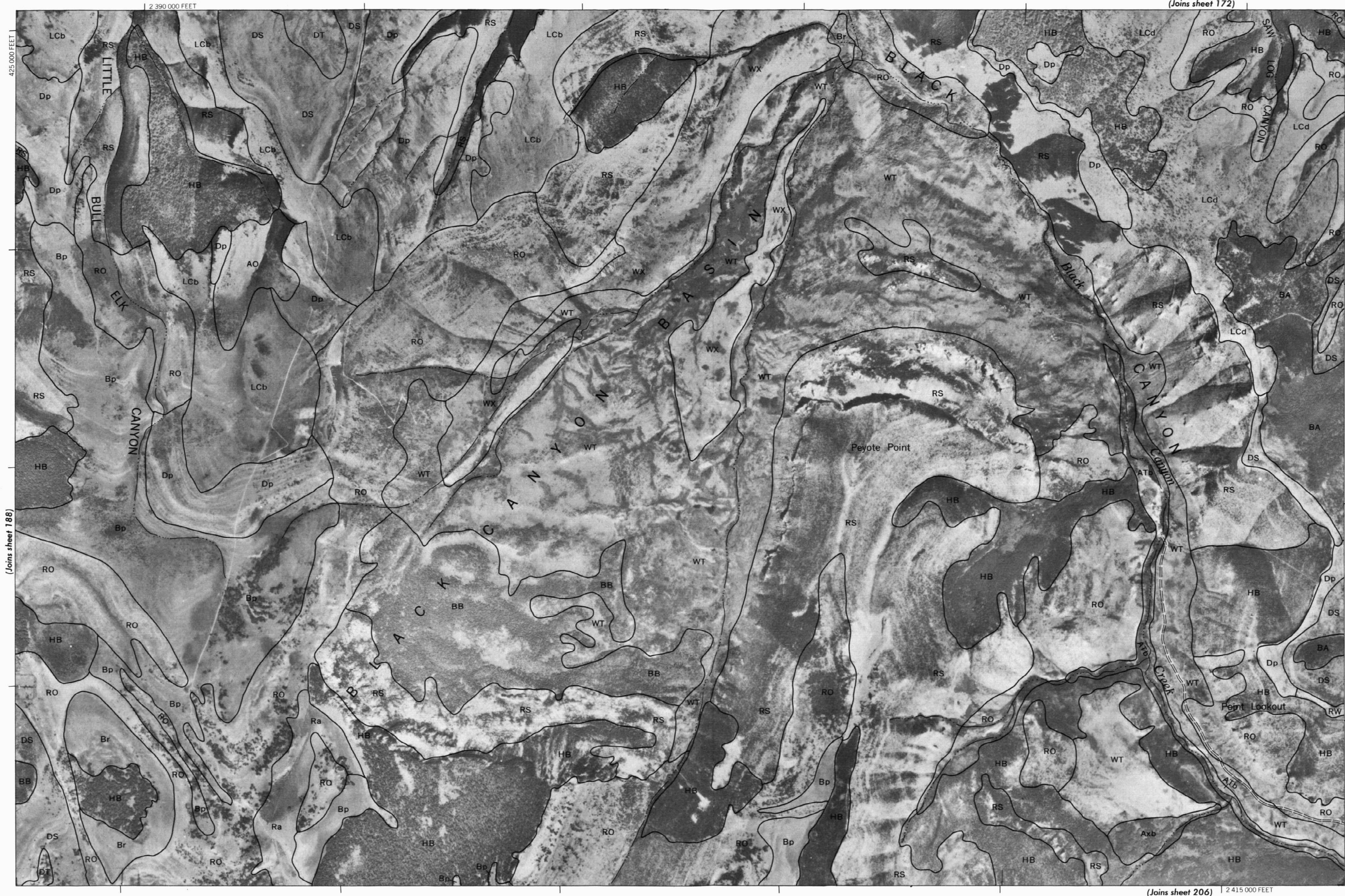
425 000 FEET



This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.  
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



(Joins sheet 188)

(Joins sheet 190)

(Joins sheet 206) 2 415 000 FEET



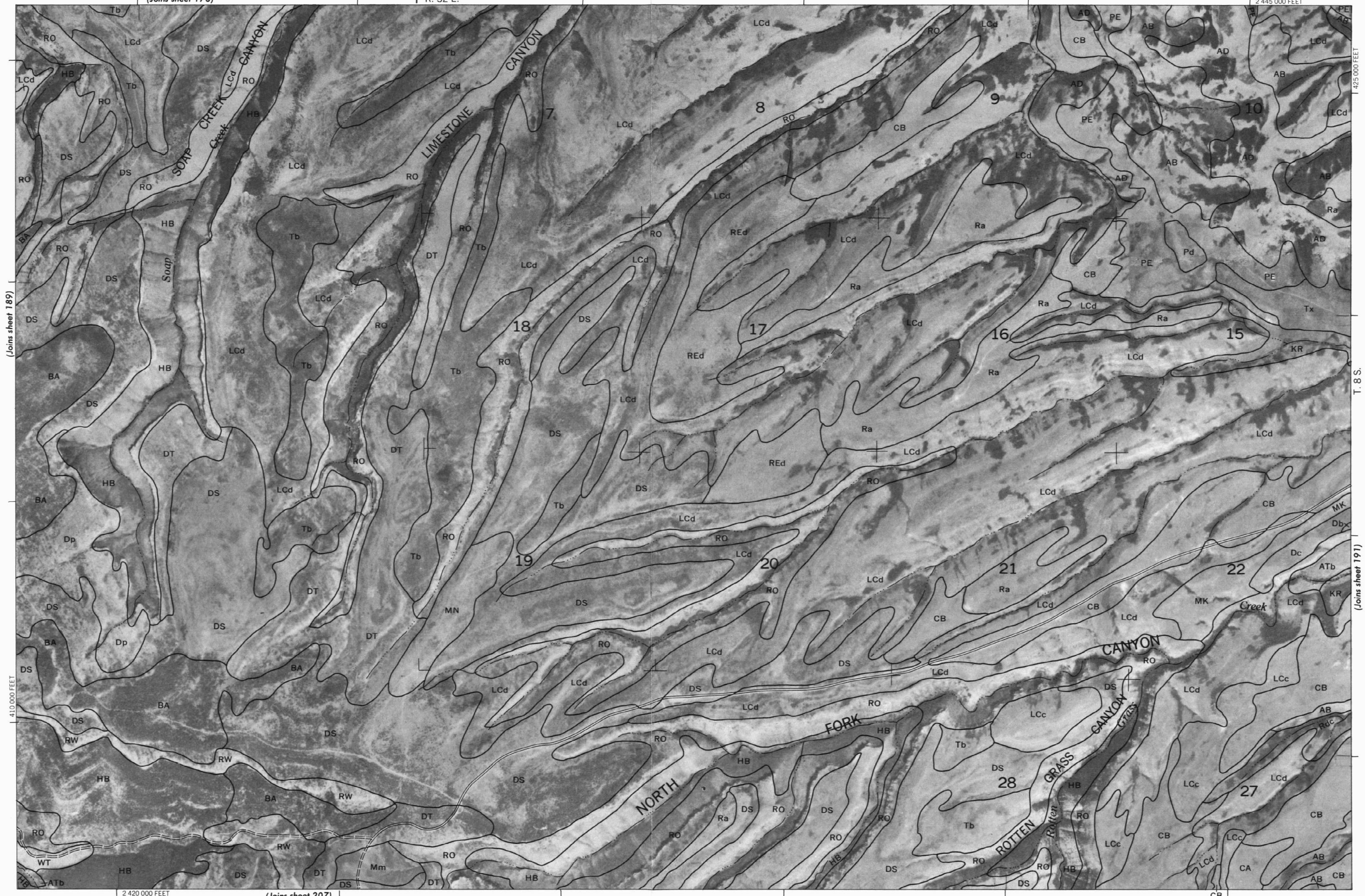
(Joins sheet 173)

R. 32 E.

2 445 000 FEET



Scale 1:24000



2 420 000 FEET

(Joins sheet 207)

T. 8 S.

(Joins sheet 191)

425 000 FEET

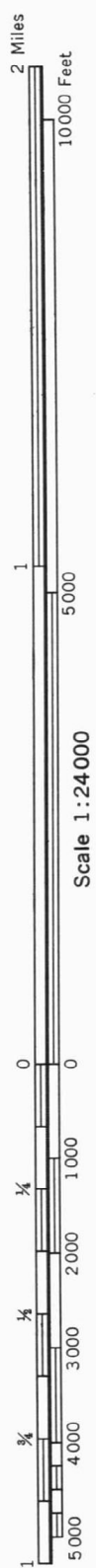


(Joins sheet 190)



(Joins sheet 208) | 2 475 000 FEET



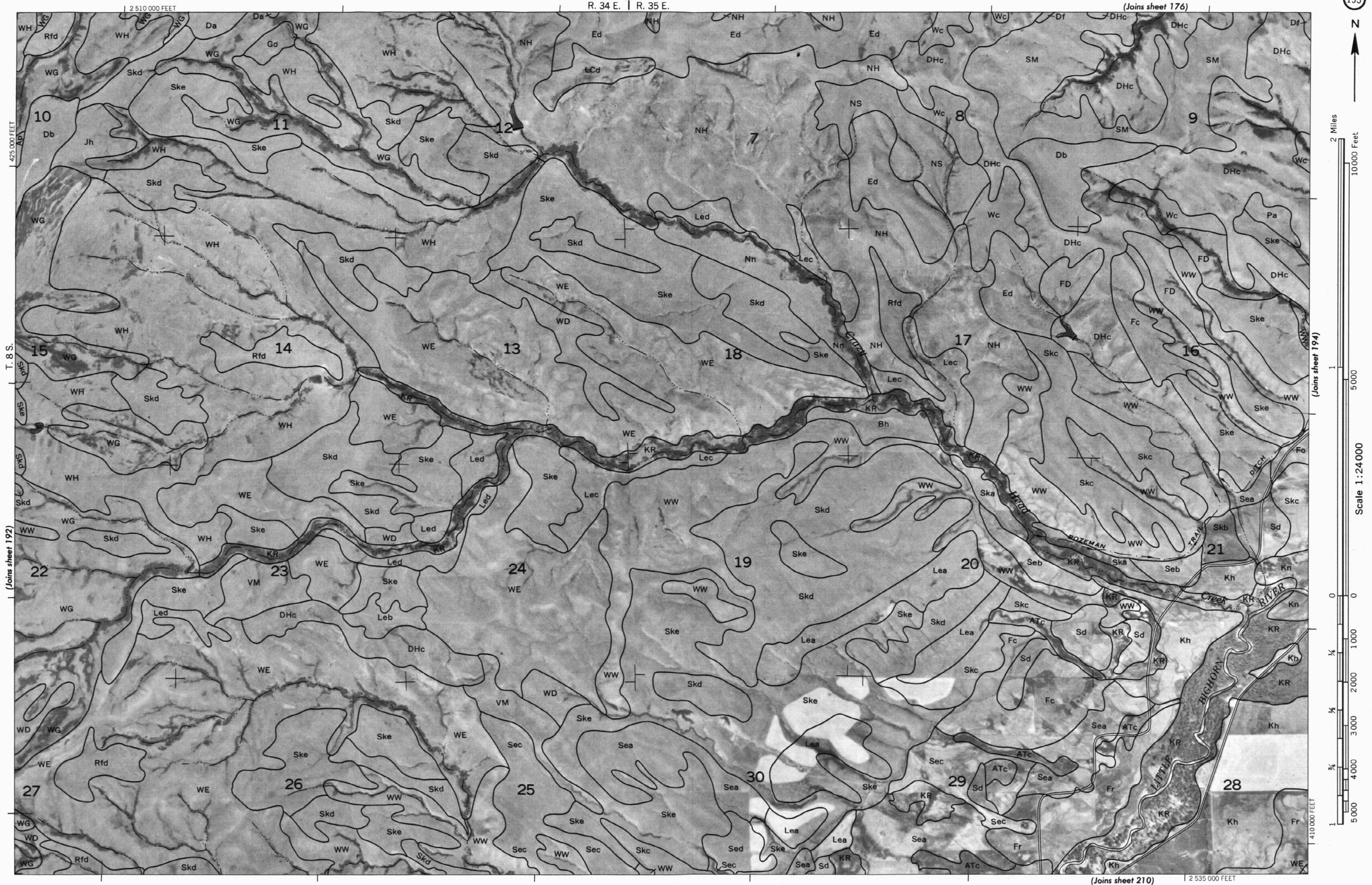


Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BIG HORN COUNTY AREA, MONTANA NO. 1922



BIG HORN COUNTY AREA, MONTANA NO. 793

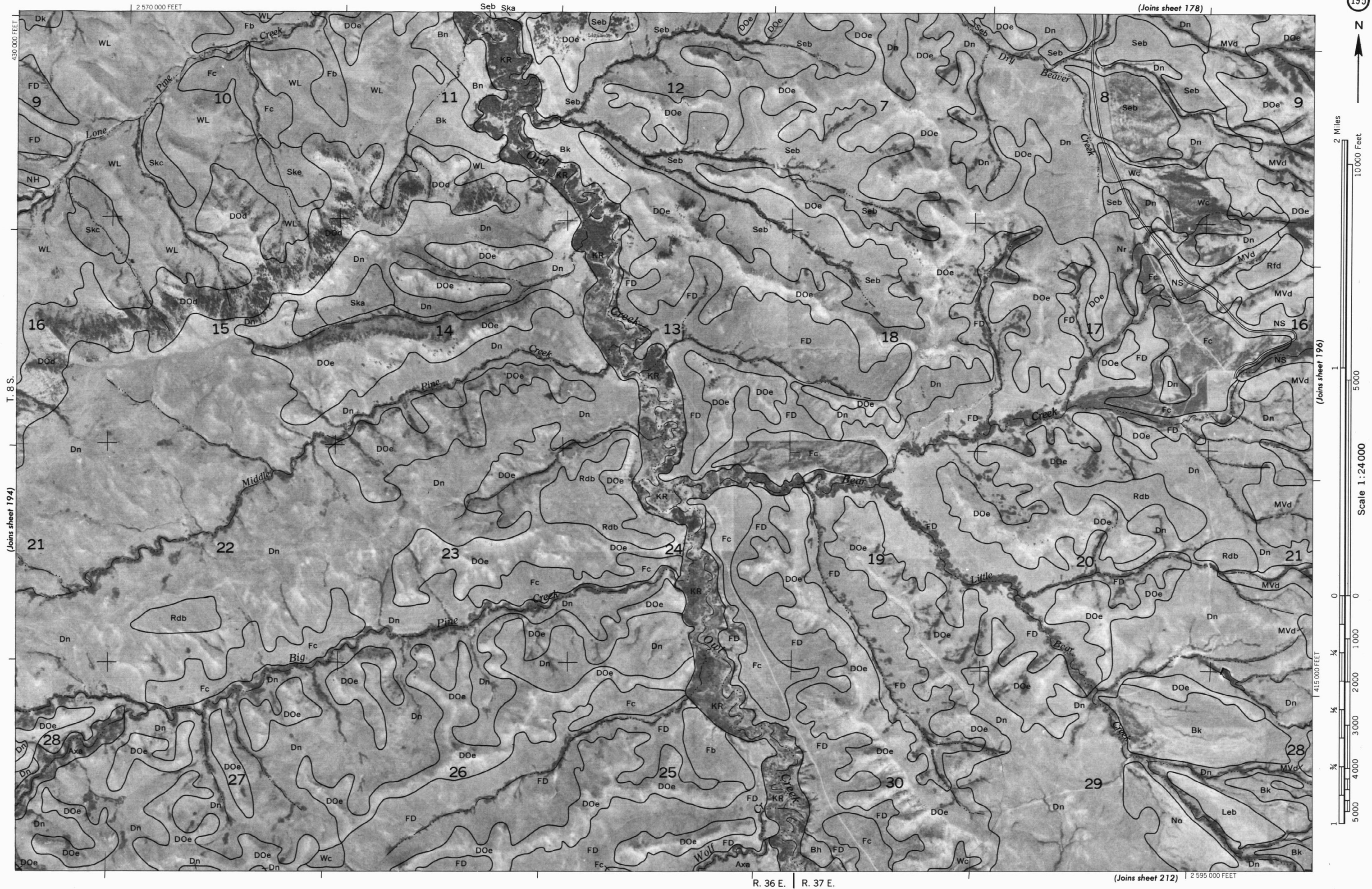








This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.





430 000 FEE I

1.85

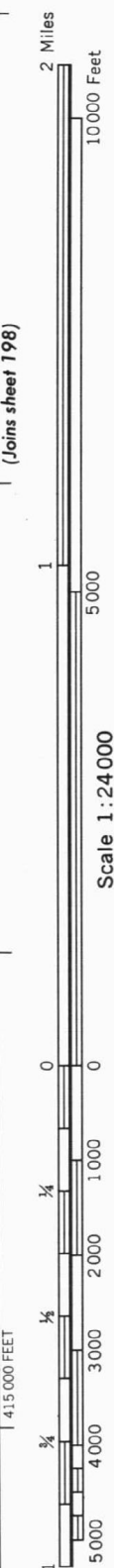
(Joins sheet 197)

Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BIG HORN COUNTY AREA. MONTANA. NO. 196



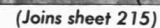
This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



(Joins sheet 198)

Scale 1:24 000

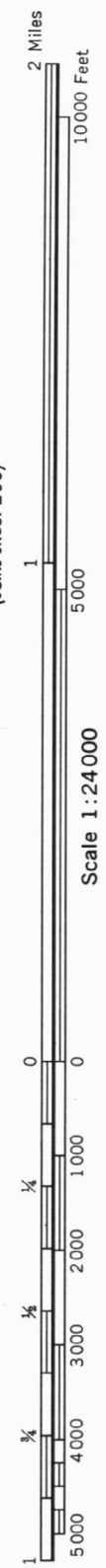




This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BIG HORN COUNTY AREA, MONTANA NO. 198





R. 40 E. | R. 41 E.

(Joins sheet 216)

2 715 000 FEET

(Joins sheet 198)

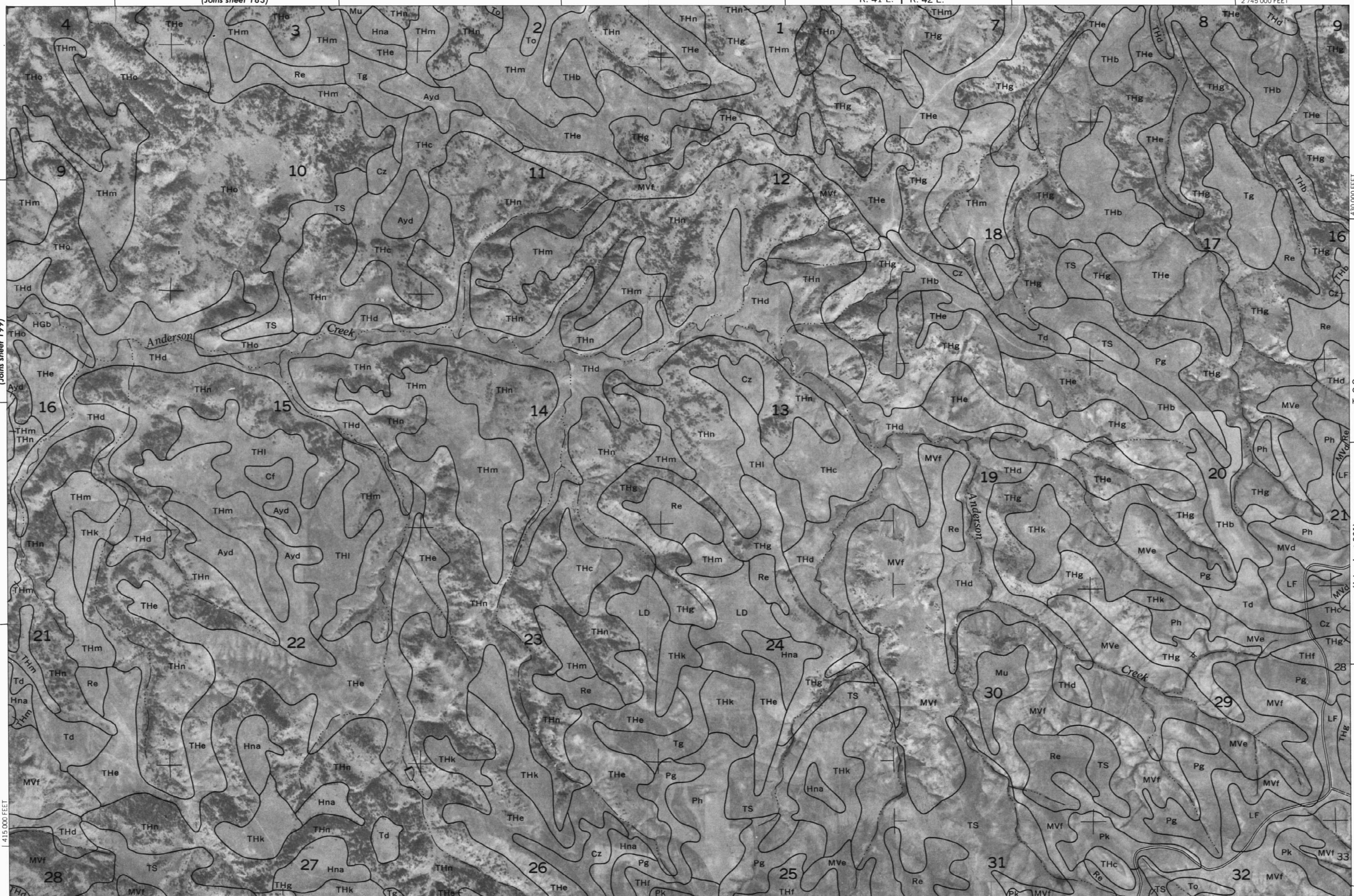
(Joins sheet 200)

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BIG HORN COUNTY AREA, MONTANA NO. 199



(Joins sheet 183)



2 720 000 FEET

(Joins sheet 217)

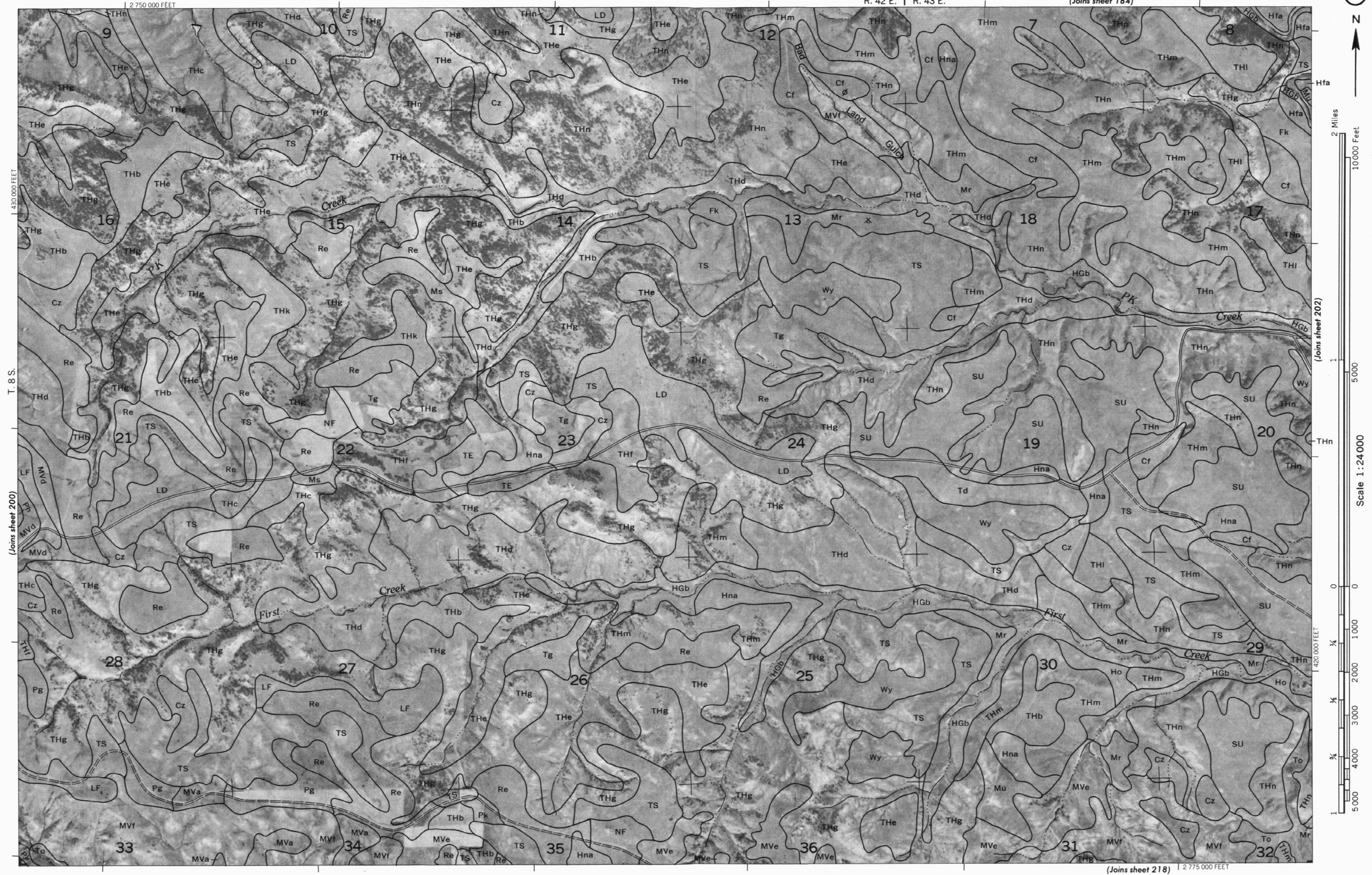
430 000 FEET

T. 8 S.

(Joins sheet 201)



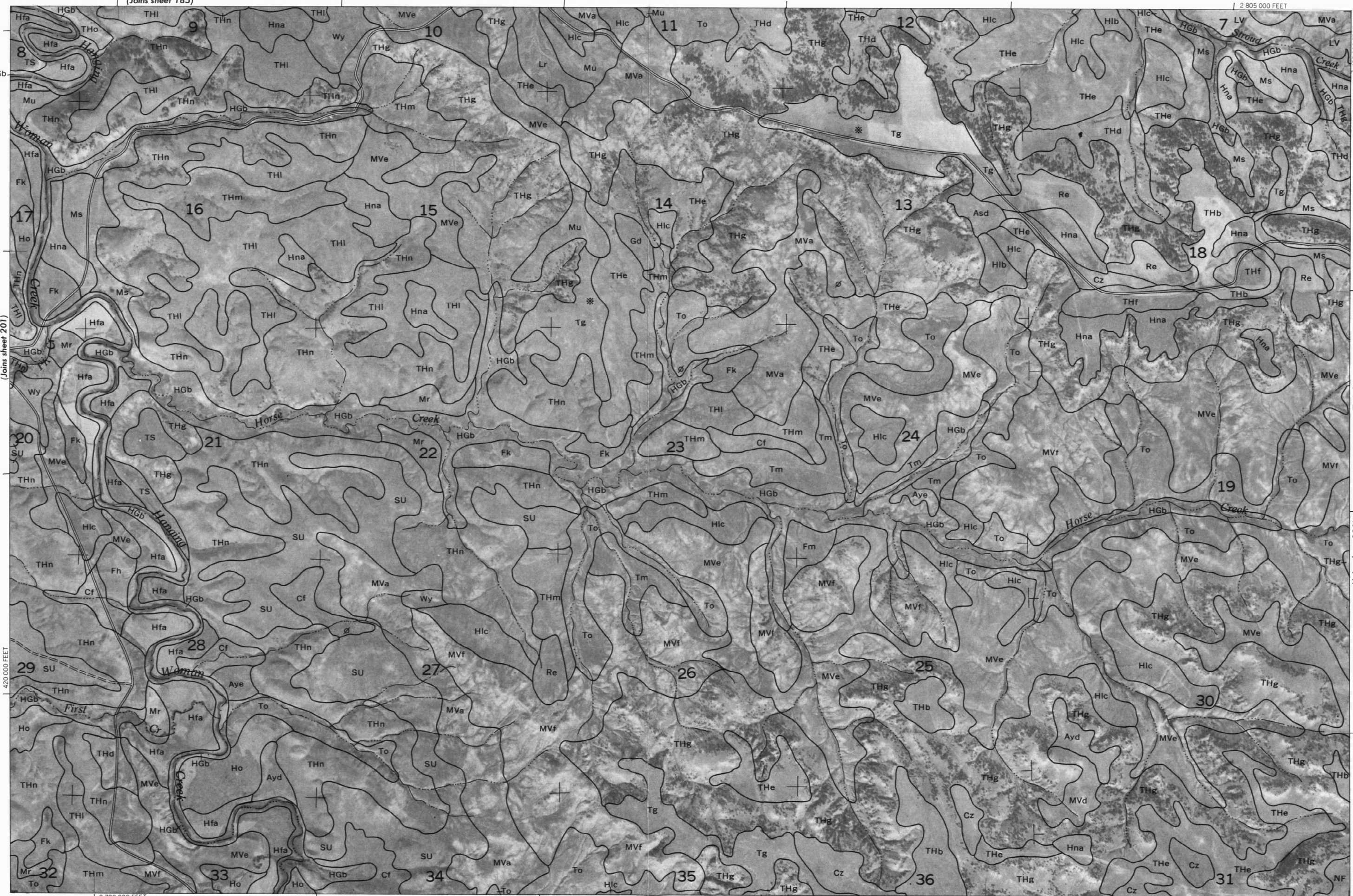
This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.







Scale 1:24 000

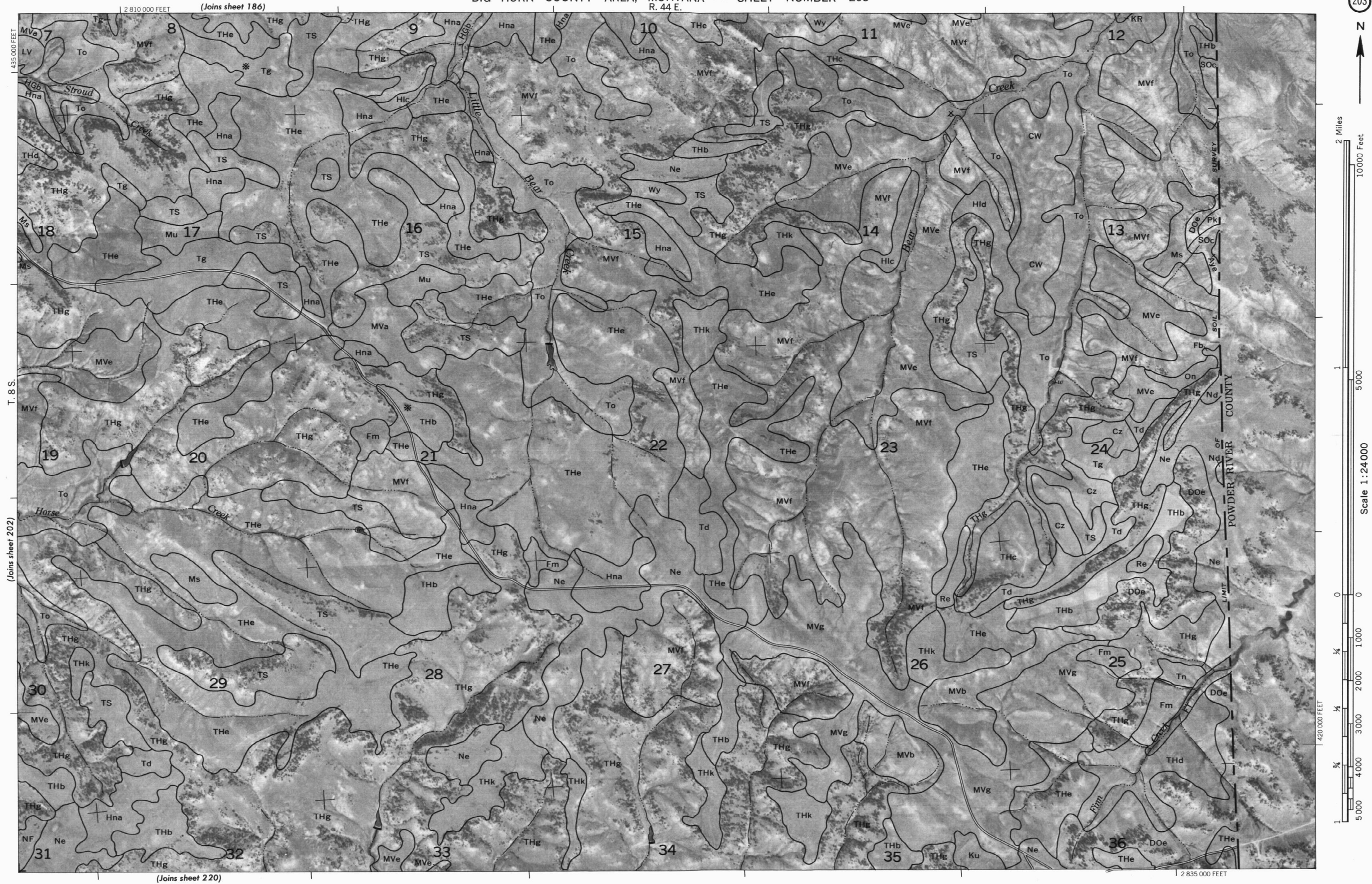


This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

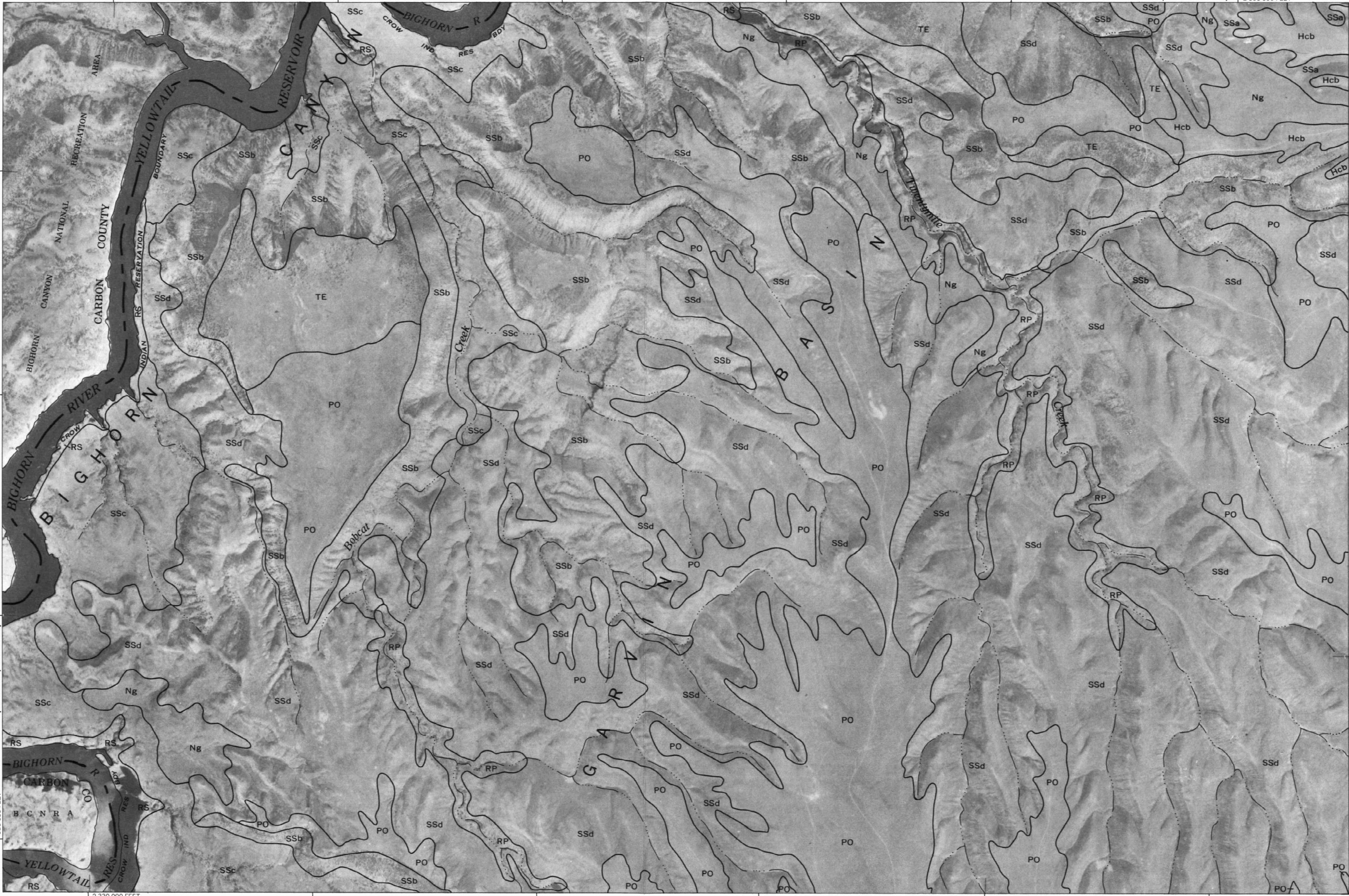
BIG HORN COUNTY AREA, MONTANA NO. 202



This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



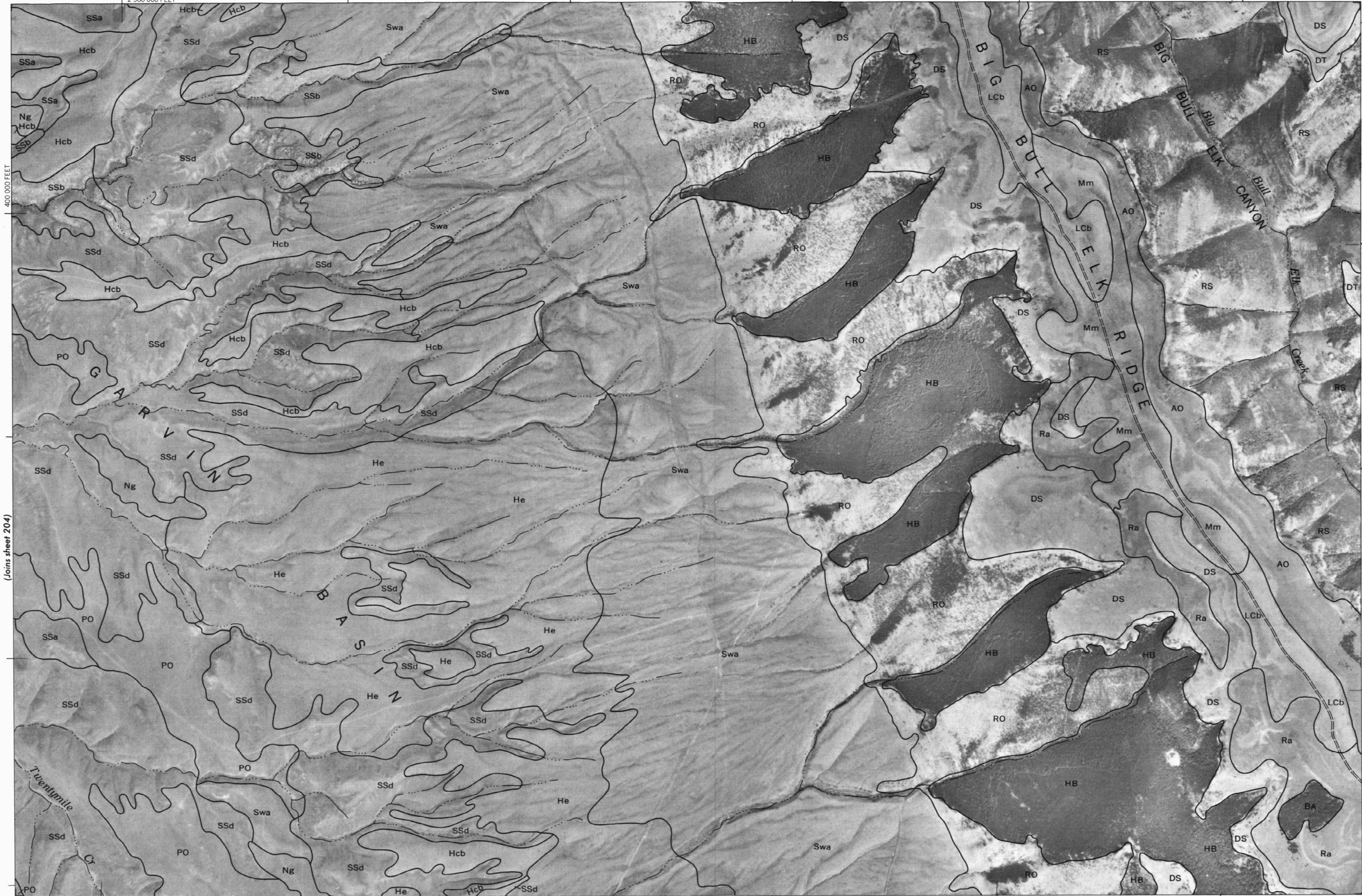




(Joins sheet 205)



(Joins sheet 188)



2 Miles

10000 Feet

1 5000

Scale 1:24000

390 000 FEET

1 1/4 1/2 3/4 1 1 1/4 1 1/2 1 3/4 2 2 1/4 2 1/2 2 3/4 3 3 1/4 3 1/2 3 3/4 4 4 1/4 4 1/2 4 3/4 5 5 1/4 5 1/2 5 3/4 6 6 1/4 6 1/2 6 3/4 7 7 1/4 7 1/2 7 3/4 8 8 1/4 8 1/2 8 3/4 9 9 1/4 9 1/2 9 3/4 10

5000 4000 3000 2000 1000 0

(Joins sheet 222) | 2 385 000 FEET

(Joins sheet 204)

(Joins sheet 206)

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BIG HORN COUNTY AREA, MONTANA NO. 205



(Joins sheet 189)

2 415 000 FEET



2 Miles  
10000 Feet

1 5000

Scale 1:24,000

0 0

1/4 1000

1/4 2000

1/4 3000

1/4 4000

1/4 5000

1 5000

1 5000

1 5000

1 5000

1 5000

1 5000



(Joins sheet 205)

390 000 FEET

2 390 000 FEET

(Joins sheet 223)

(Joins sheet 207)

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.  
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



2 420 000 FEET

R. 32 E.

(Joins sheet 190)



2 Miles  
10000 Feet

1  
5000

Scale 1:24 000

0 0 1000 2000 3000 4000 5000  
1/4 1/2 3/4

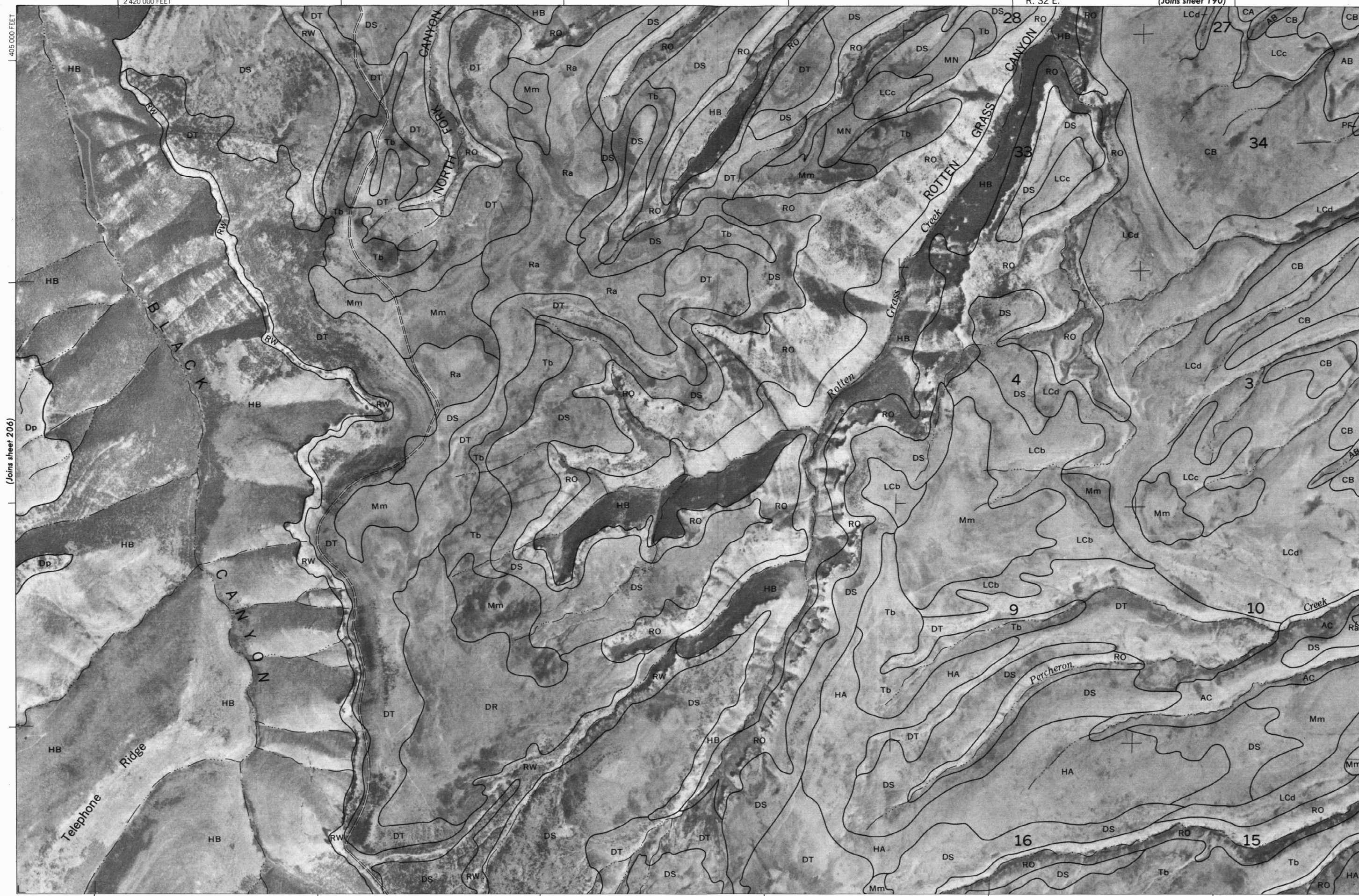
T. 9 S. | T. 8 S.

(Joins sheet 206)

(Joins sheet 208)

(Joins sheet 224) 2 445 000 FEET

BIG HORN COUNTY AREA, MONTANA NO. 207  
This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.  
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



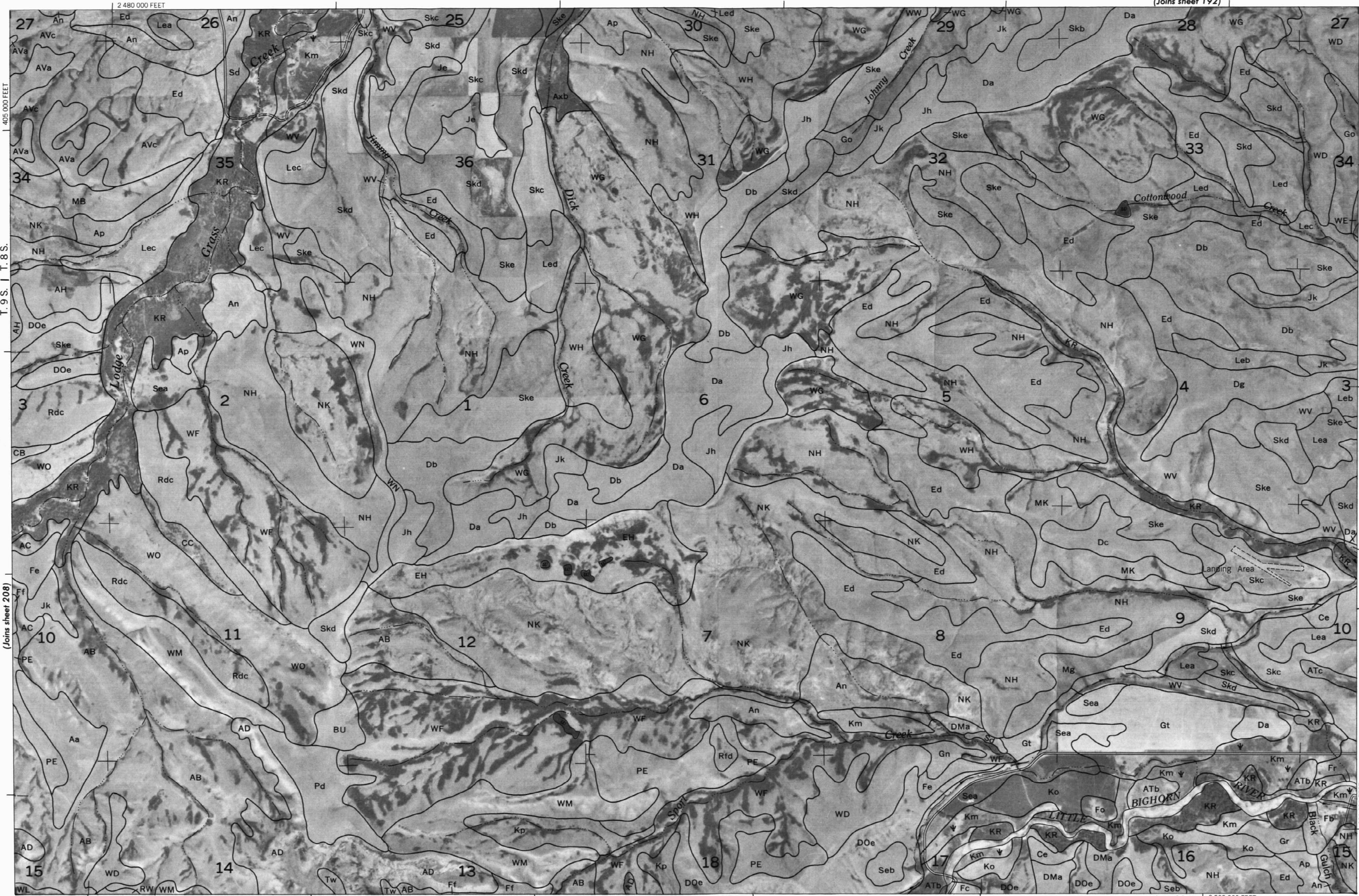






(Joins sheet 192)

2 480 000 FEET



2 Miles  
10 000 Feet  
Scale 1:24 000

Scale 1:24 000

1 390 000 FEET

R. 33 E. | R. 34 E.

(Joins sheet 226) | 2 505 000 FEET

(Joins sheet 208)

(Joins sheet 210)

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

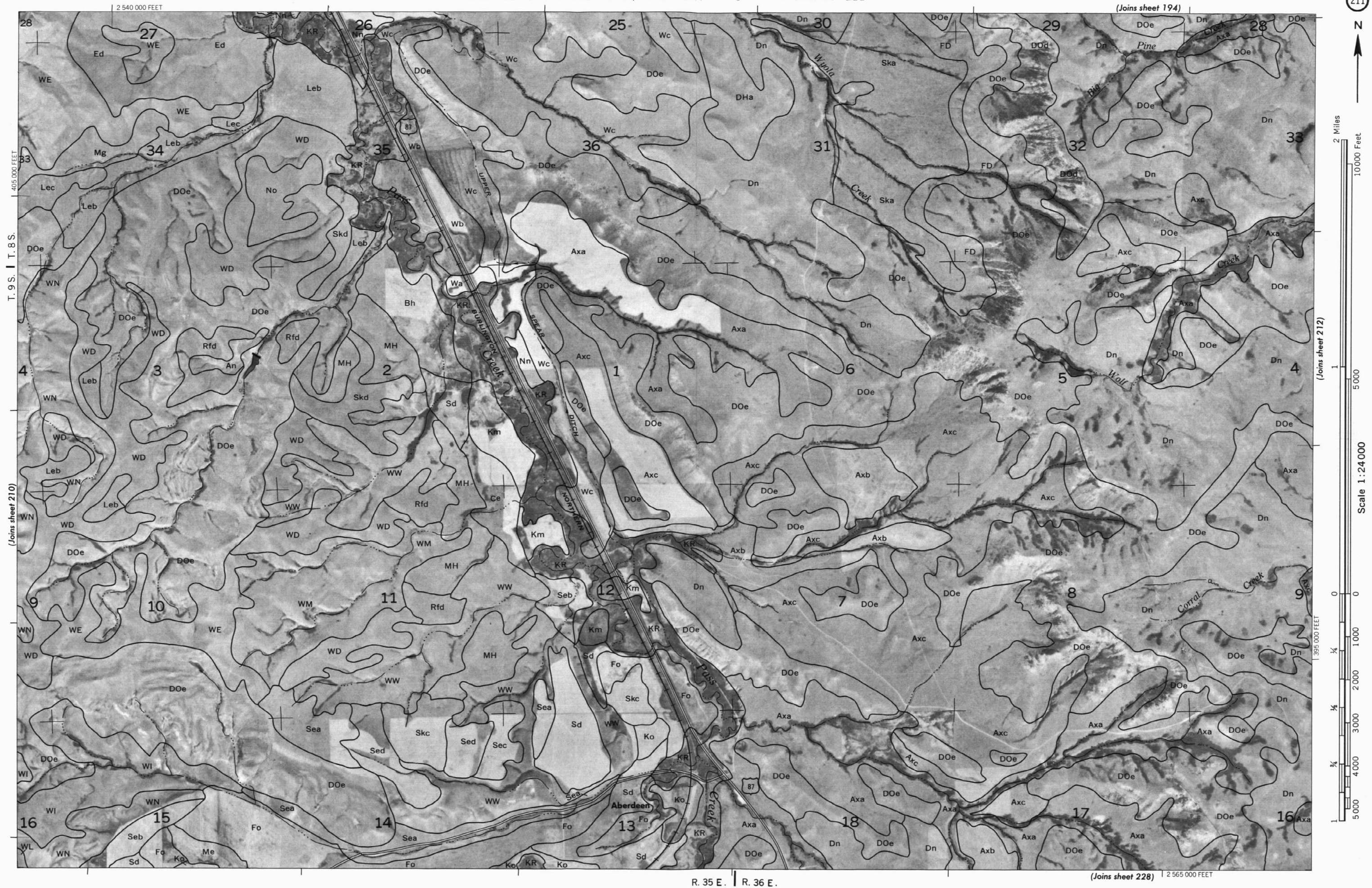
BIG HORN COUNTY AREA, MONTANA NO. 209







This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.





(Joins sheet 195)

2 595 000 FEET



2 Miles

10 000 Feet

1

5 000

Scale 1:24 000

0

0

1/4

1 000

2 000

3 000

4 000

5 000

1/4

2 000

3 000

4 000

5 000

1/4

2 000

3 000

4 000

5 000

1/4

2 000

3 000

4 000

5 000

1/4

2 000

3 000

4 000

5 000

1/4

2 000

3 000

4 000

5 000

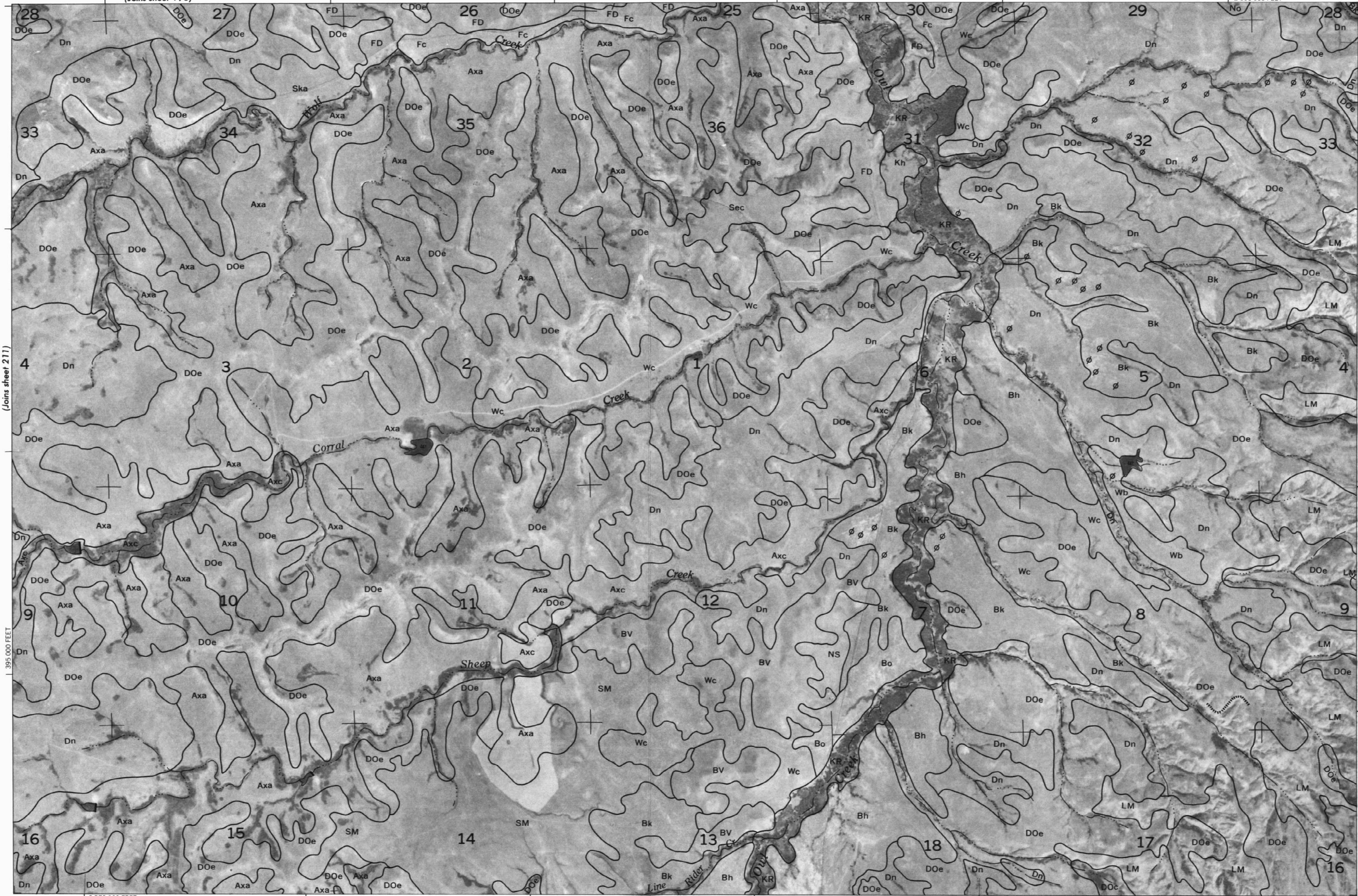
1/4

2 000

3 000

4 000

5 000



2 570 000 FEET (Joins sheet 229)

R. 36 E. | R. 37 E.

T. 8 S.

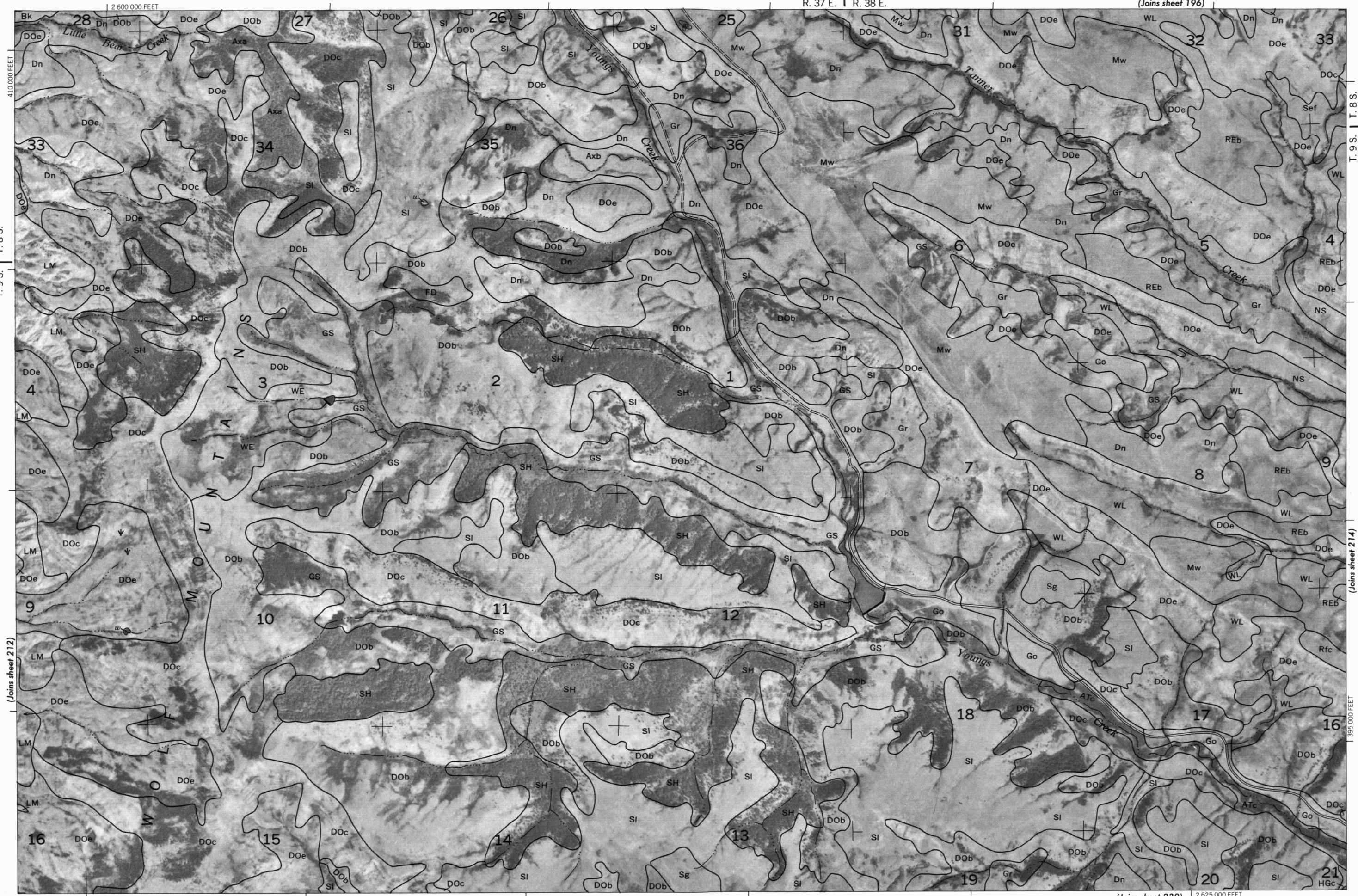
(Joins sheet 213)

T. 9 S.

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BIG HORN COUNTY AREA, MONTANA NO. 212





This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.  
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BIG HORN COUNTY AREA, MONTANA NO. 213



(Joins sheet 197)

2 655 000 FEET



2 Miles

10000 Feet

1

5000

Scale 1:24000

0

0

1000

2000

3000

4000

5000

395 000 FEET

1

1/4

1/2

3/4

1

1/4

1/2

3/4

1

1/4

1/2

3/4

1

1/4

1/2

3/4

1

1/4

1/2

3/4

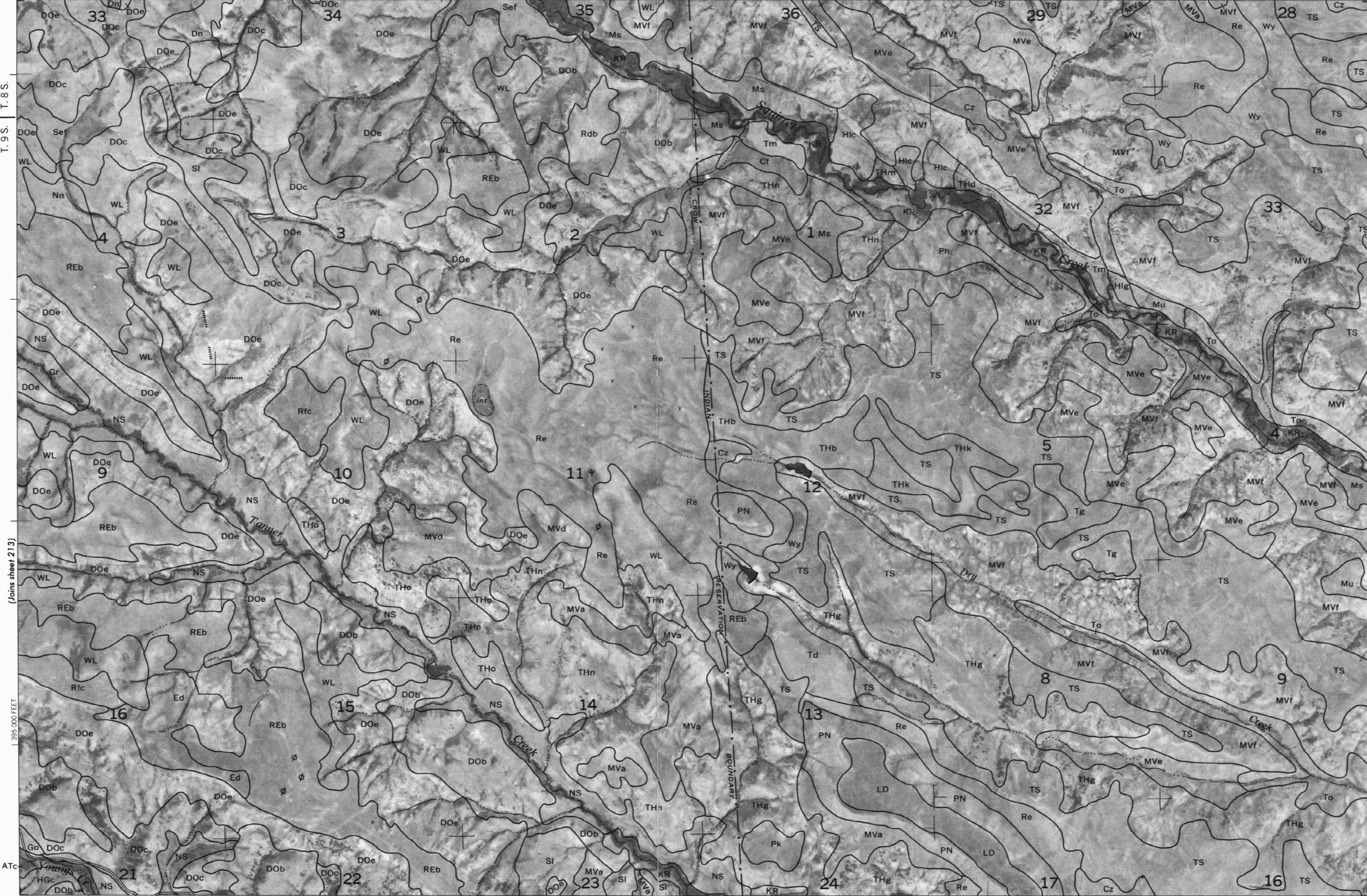
1

1/4

1/2

3/4

1



2 630 000 FEET

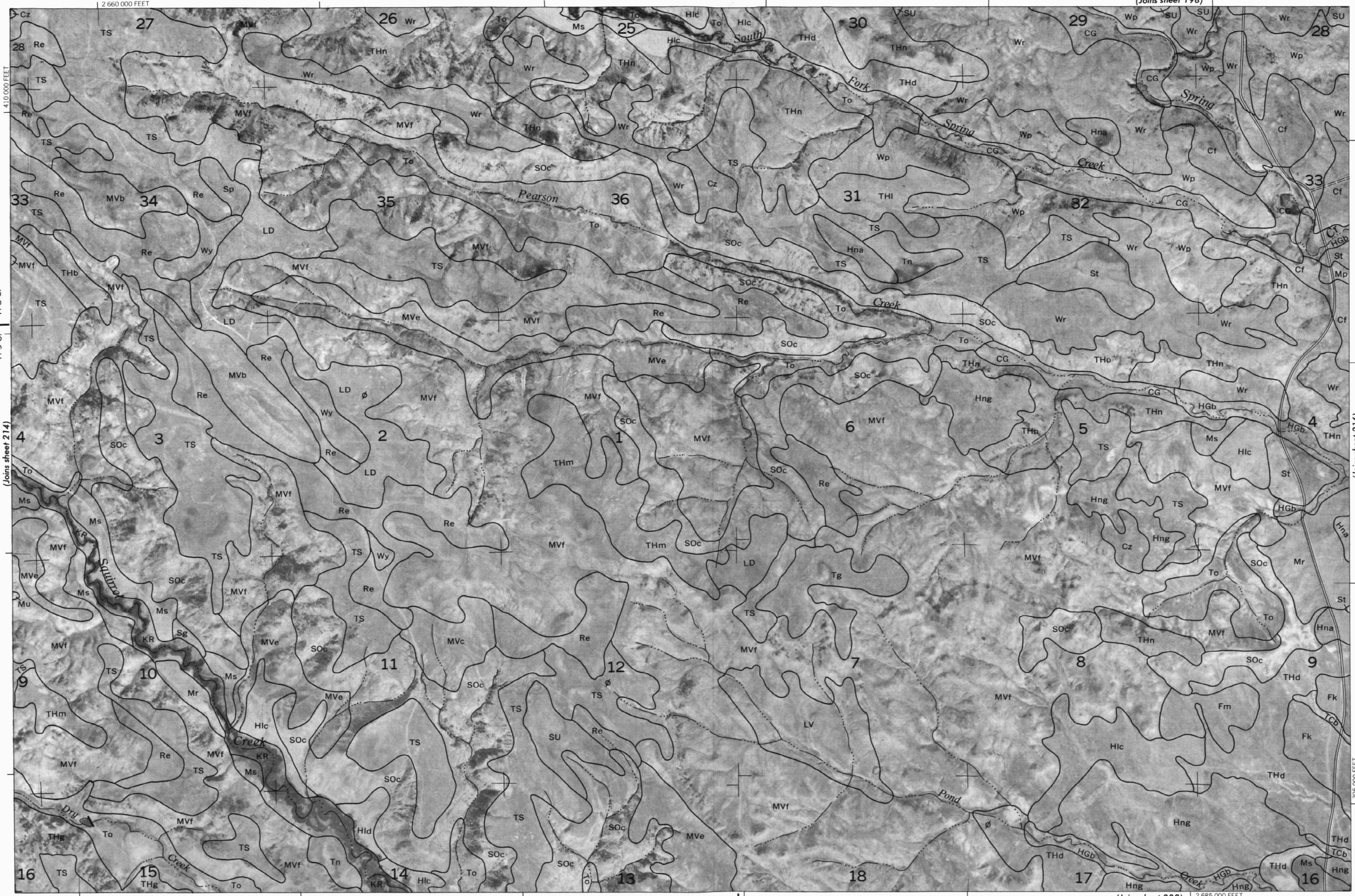
(Joins sheet 231)

(Joins sheet 215)

T. 9 S. | T. 8 S.

410 000 FEET





This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BIG HORN COUNTY AREA, MONTANA NO. 215

T. 9 S. | T. 8 S.

R. 39 E. | R. 40 E.

(Joins sheet 198)

(Joins sheet 216)

(Joins sheet 232) 2 685 000 FEET



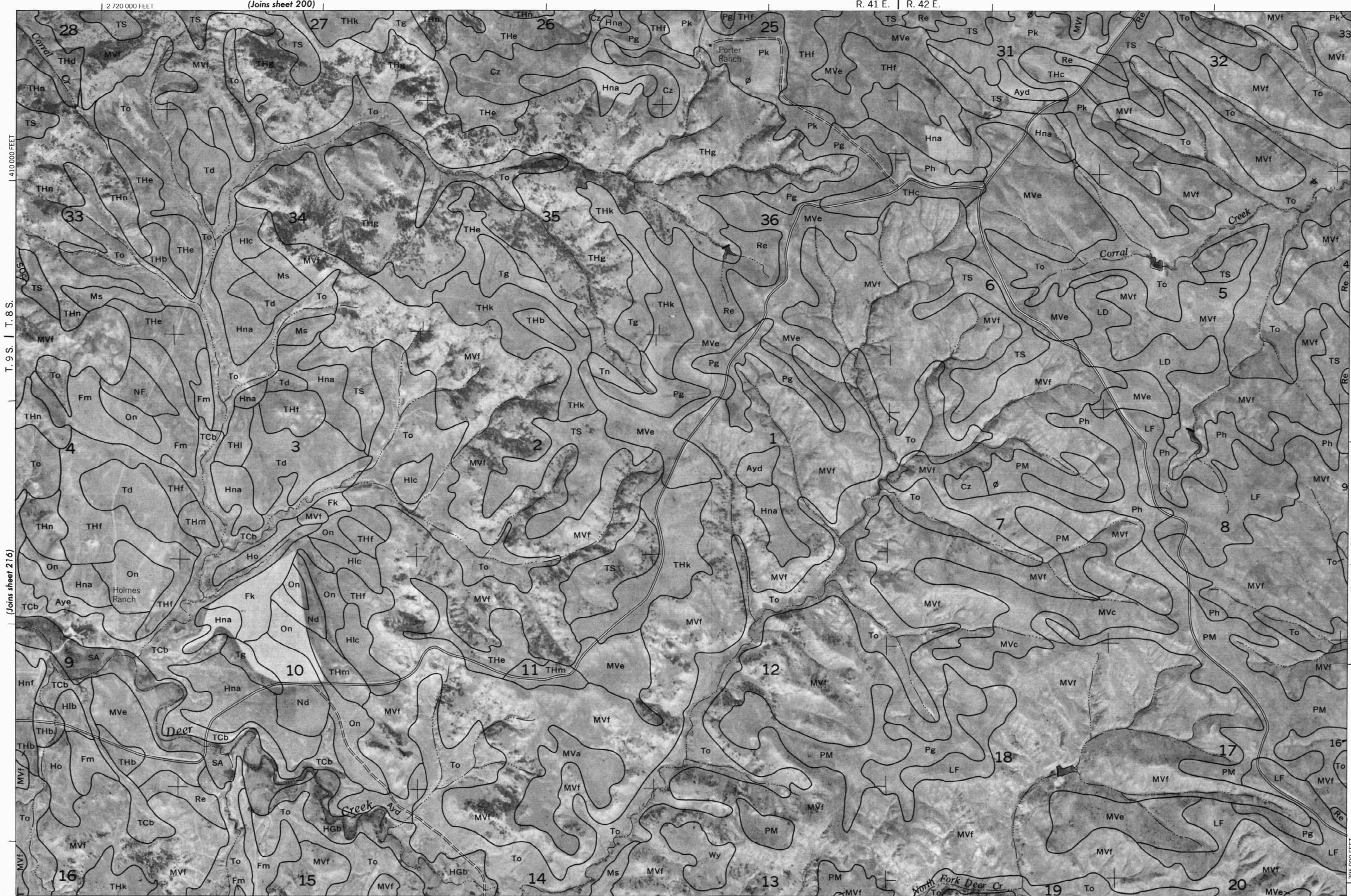




2 720 000 FEET

(Joins sheet 200)

BIG HORN COUNTY AREA, MONTANA NO. 217  
This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.  
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



(Joins sheet 218)

(Joins sheet 234)

2 745 000 FEET





2 Miles  
10000 Feet

1  
5000

Scale 1:24000

0 0 1000 2000 3000 4000 5000  
1 1/4 1/2 1/4 1/8 1/16

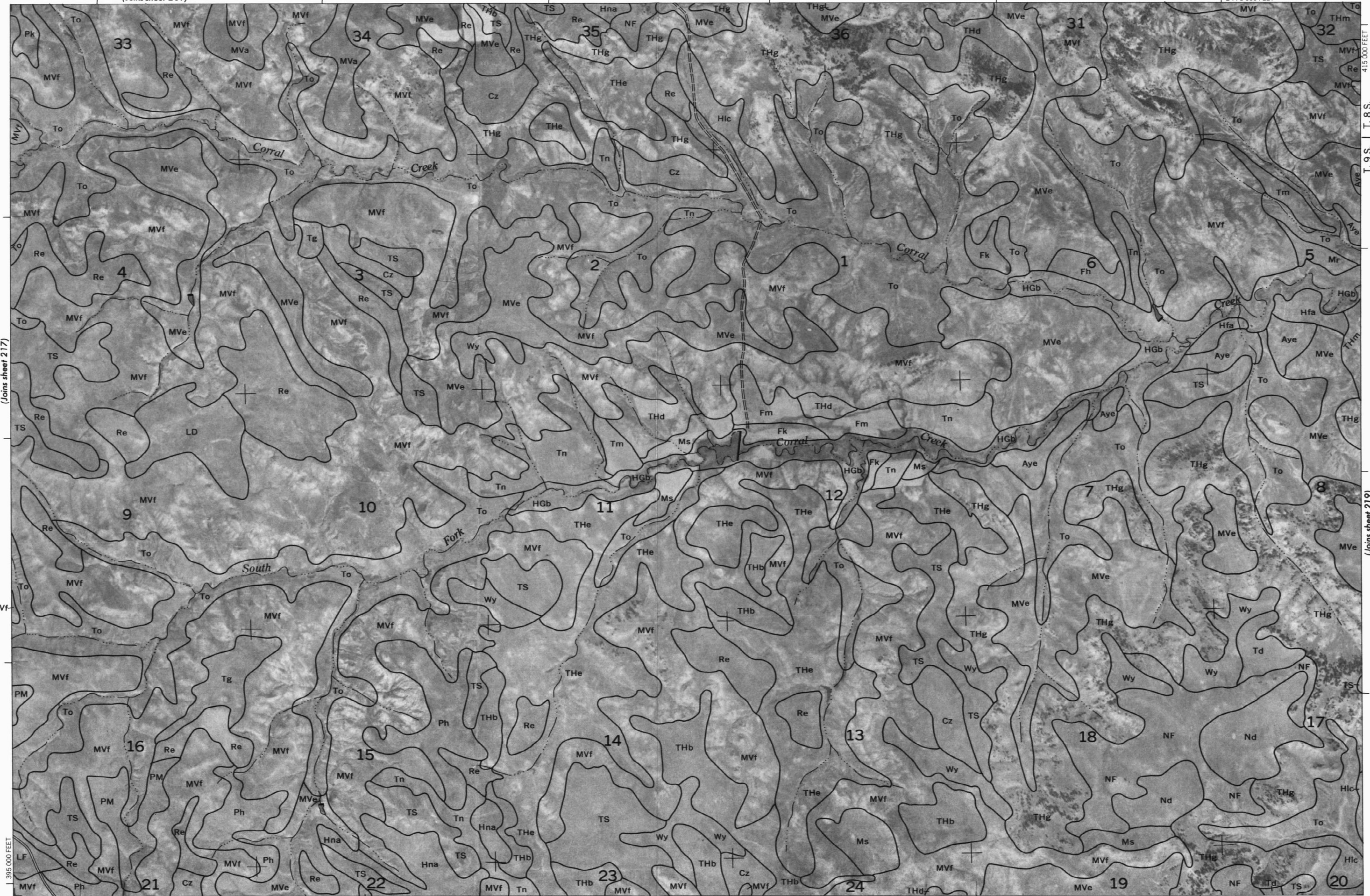
395 000 FEET

(Joins sheet 201)

2 775 000 FEET

T. 9 S. | T. 8 S.

(Joins sheet 219)

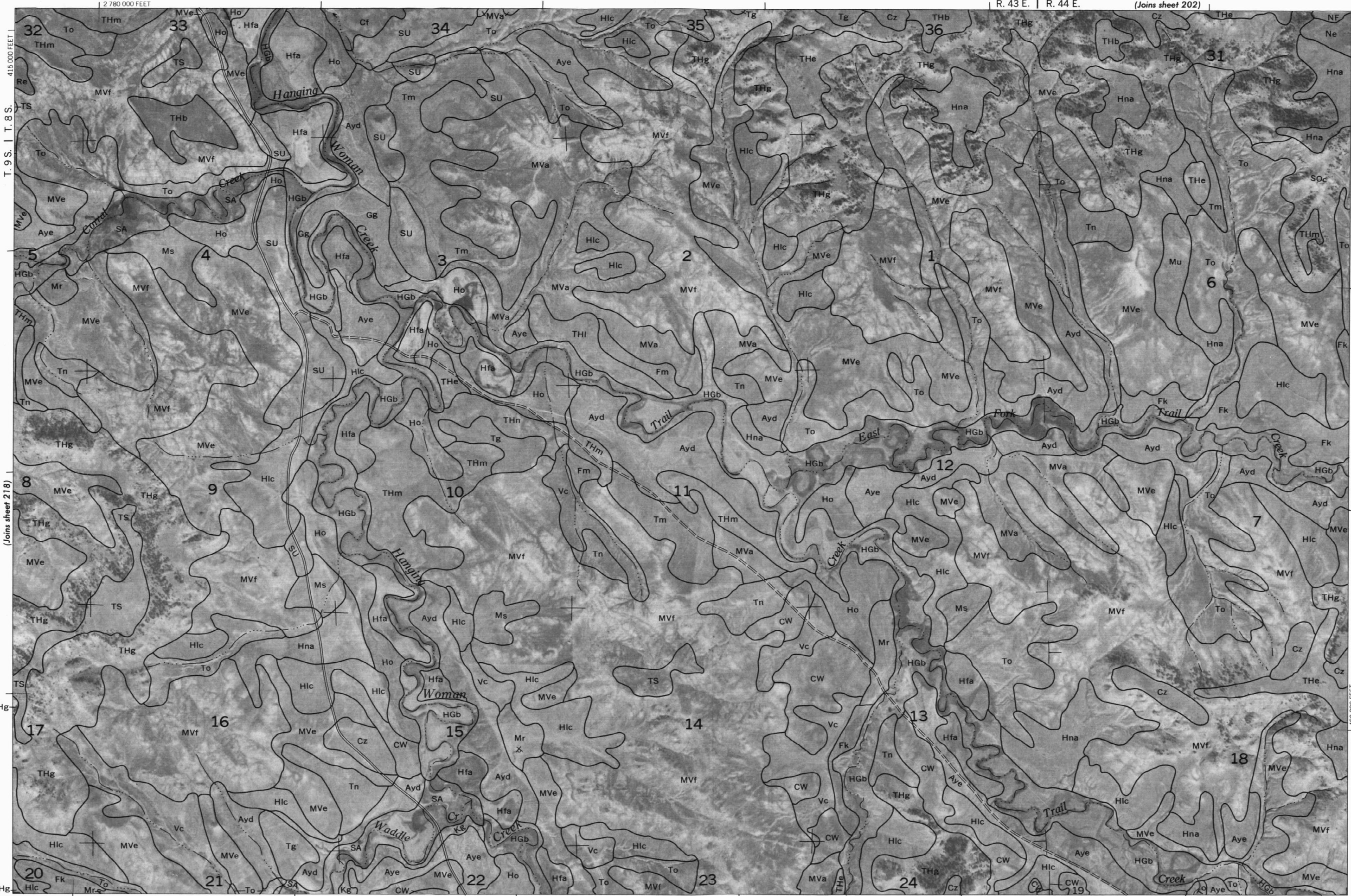


(Joins sheet 235)

R. 42 E. | R. 43 E.



2 780 000 FEET



This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BIG HORN COUNTY AREA, MONTANA NO. 219



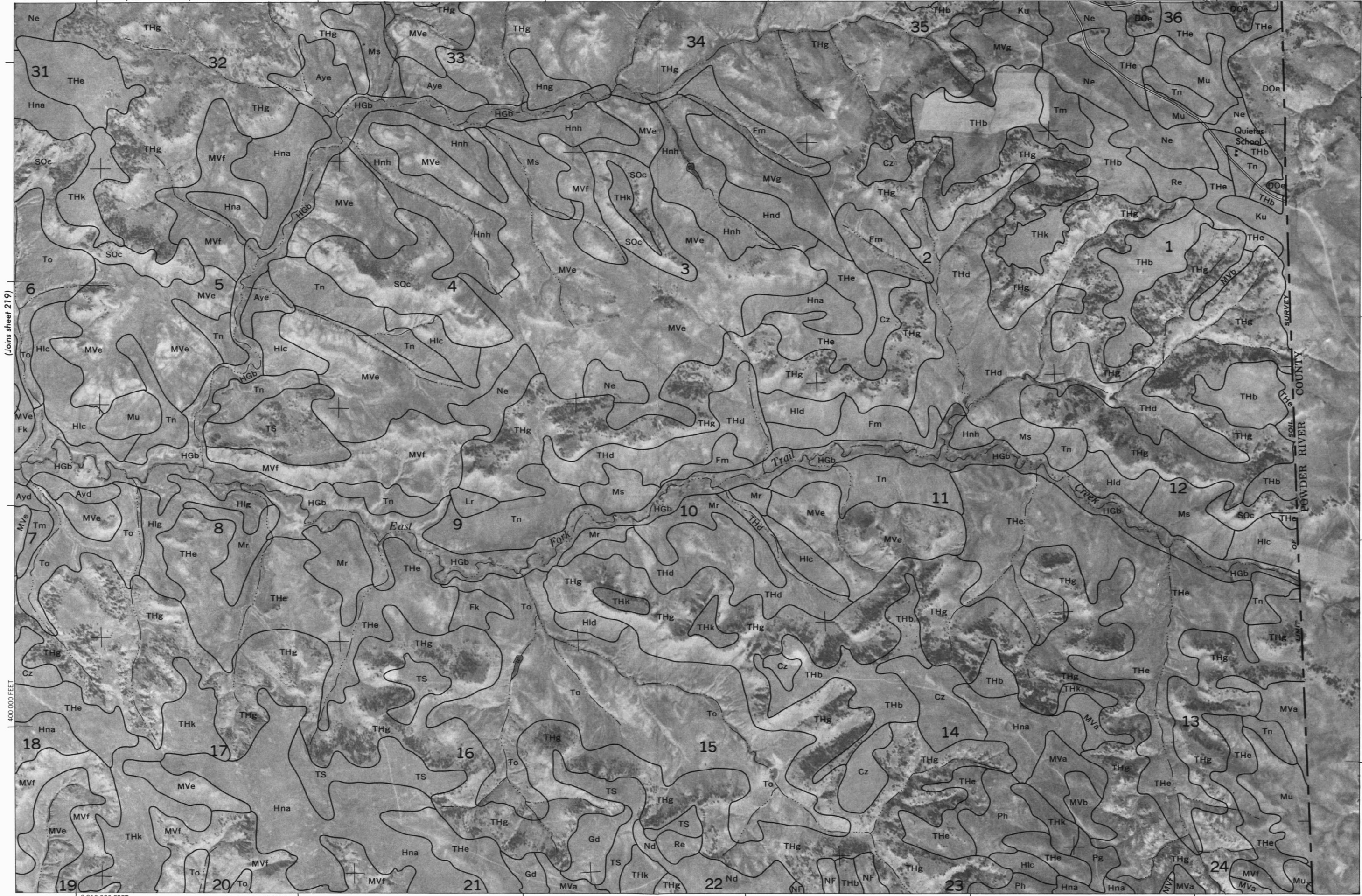
(Joins sheet 236)

2 805 000 FEET



(Joins sheet 203)

2 835 000 FEET

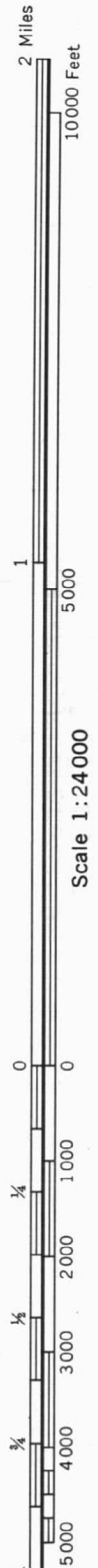
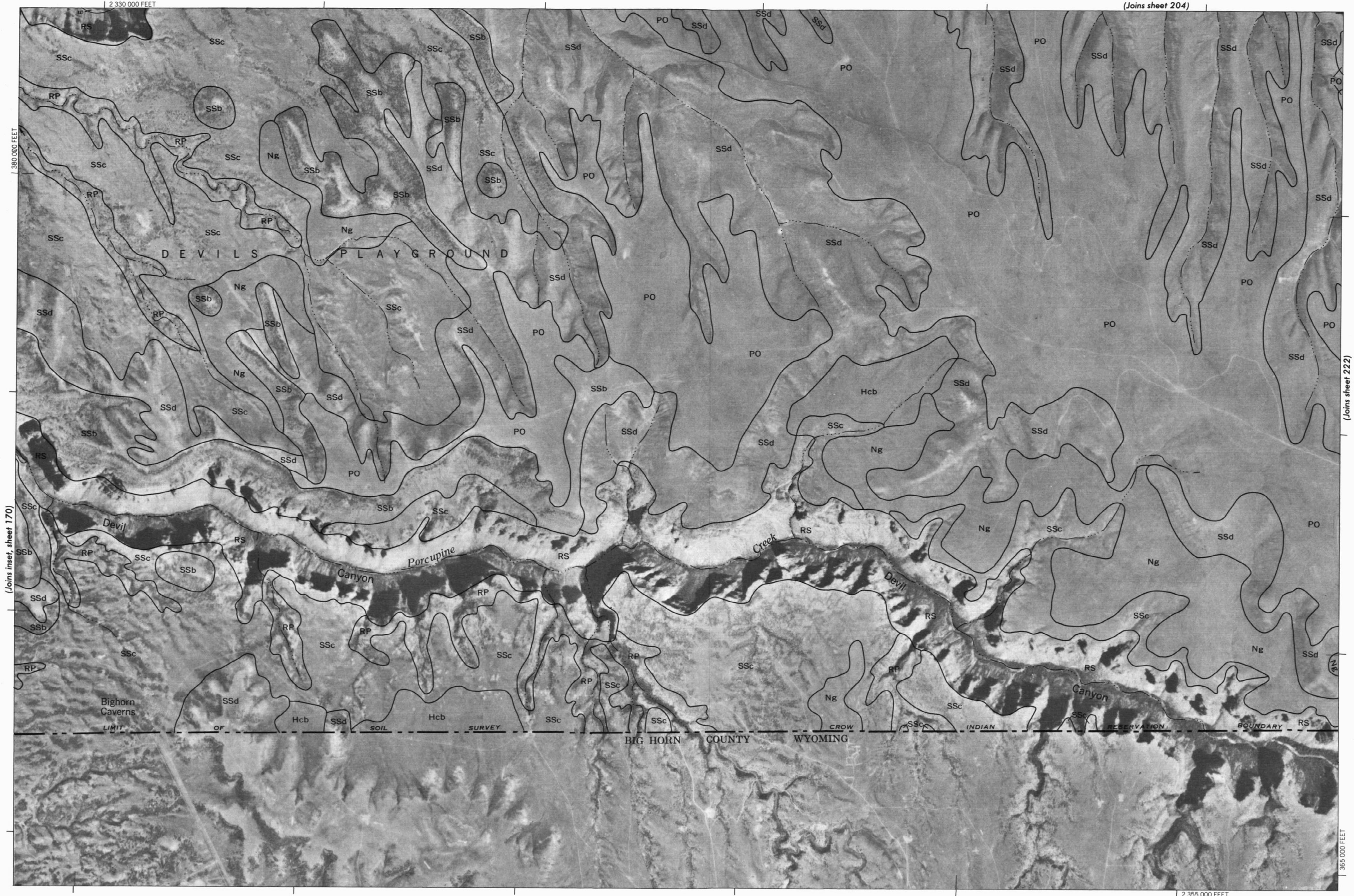


T. 9 S. | T. 8 S.

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.  
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



(Joins sheet 204)



BIG HORN COUNTY AREA, MONTANA NO. 221  
This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.  
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



(Joins sheet 205)

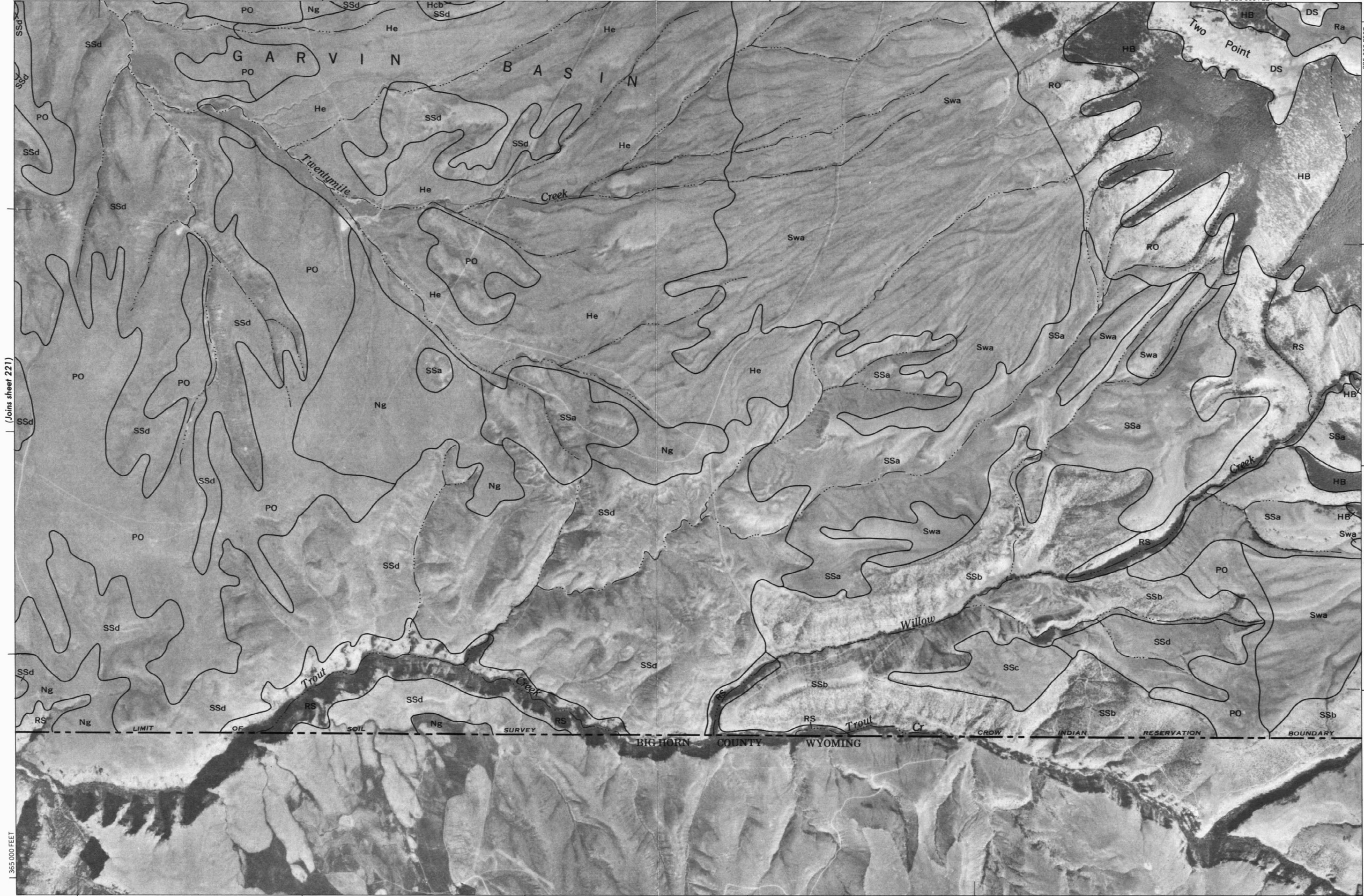
2 385 000 FEET



2 Miles  
10000 Feet

1 5000  
Scale 1:24000

0 0 1000 2000 3000 4000 5000  
365 000 FEET



(Joins sheet 221)

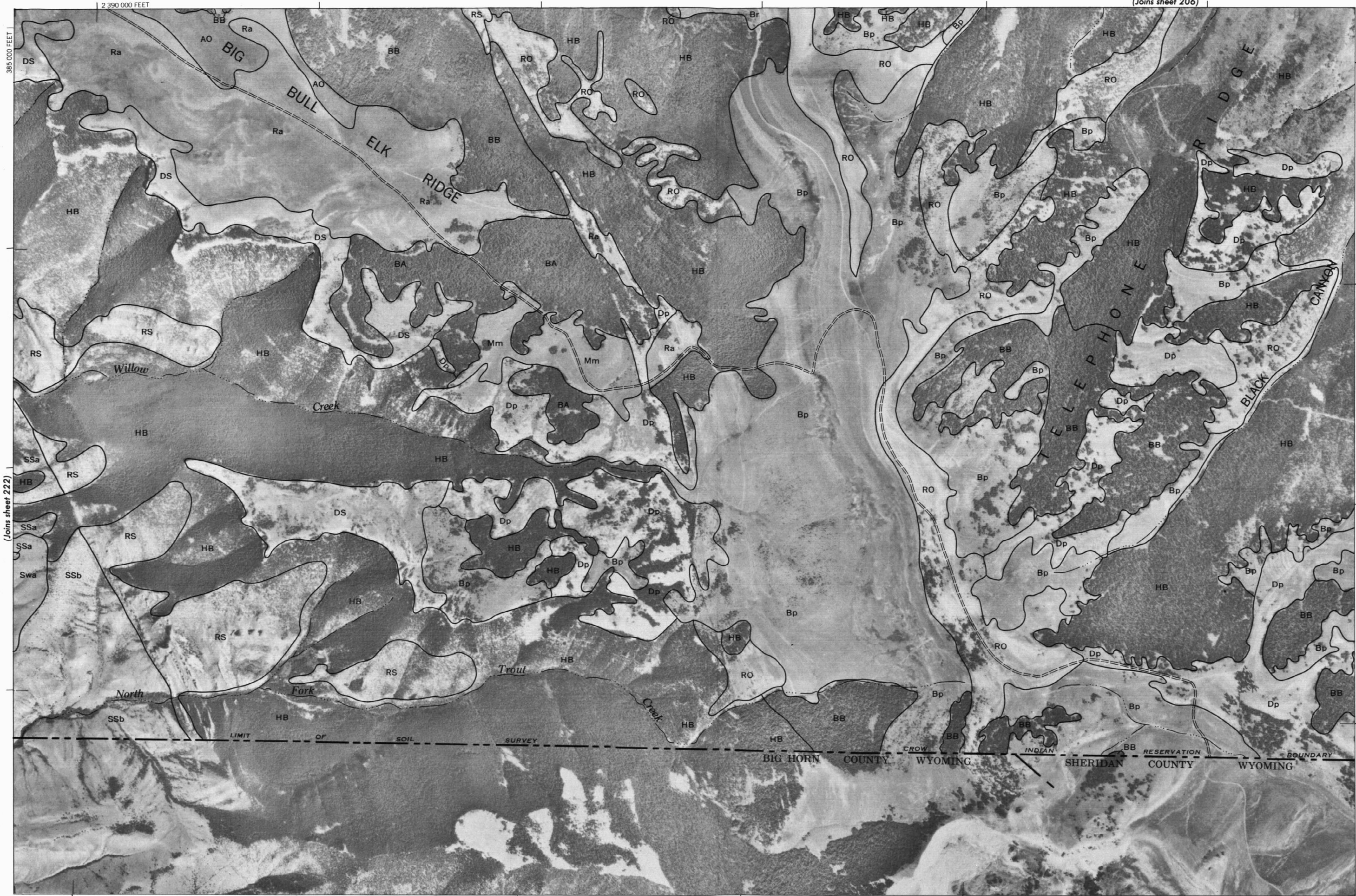
(Joins sheet 223)

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.  
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



BIG HORN COUNTY AREA, MONTANA NO. 223

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



(Joins sheet 224)

(Joins sheet 222)

(Joins sheet 206)



(Joins sheet 207)



2 Miles  
10 000 Feet

1  
5 000

Scale 1:24 000

0 0  
1 000  
2 000  
3 000  
4 000  
5 000



2 420 000 FEET

(Joins sheet 223) (Joins sheet 225)





Scale 1:24000

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

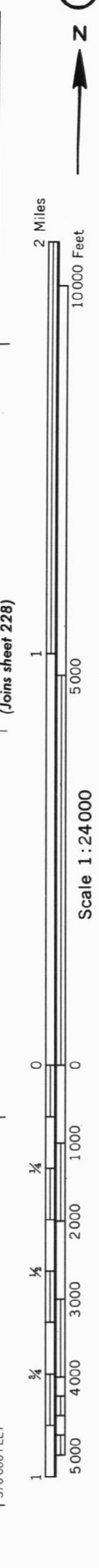








BIG HORN COUNTY AREA, MONTANA NO. 227  
This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.  
Coordinate grid ticks and land division corners, if shown, are approximately positioned.









2 595 000 FEET

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.





R. 37 E.	R. 38 E.
----------	----------

A scale bar consisting of two horizontal lines. The top line is longer and labeled "2 Miles". The bottom line is shorter and labeled "10,000 Feet".

(Joins sheet 229)

Scale 1:24 000

375 000 FEET

LIMIT OF SOIL SURVEY

SHERIDAN COUNTY WYOMING

CROW

INDIAN

Cree

100

T. 10 S.	T. 9 S.
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(Joins sheet 231)

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BIG HORN COUNTY AREA, MONTANA NO. 230



(Joins sheet 232)

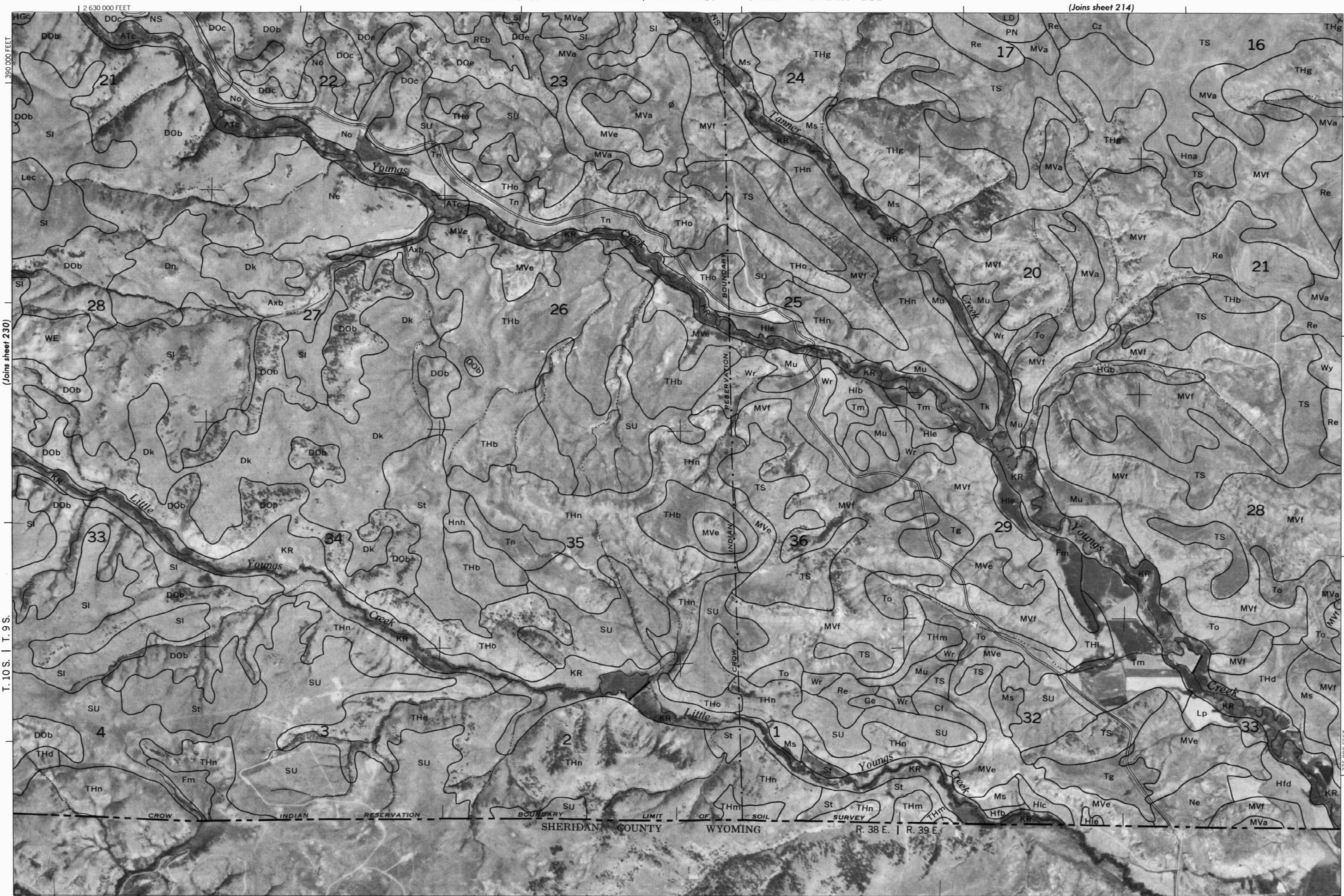
\$375,000 FEE

1 5000

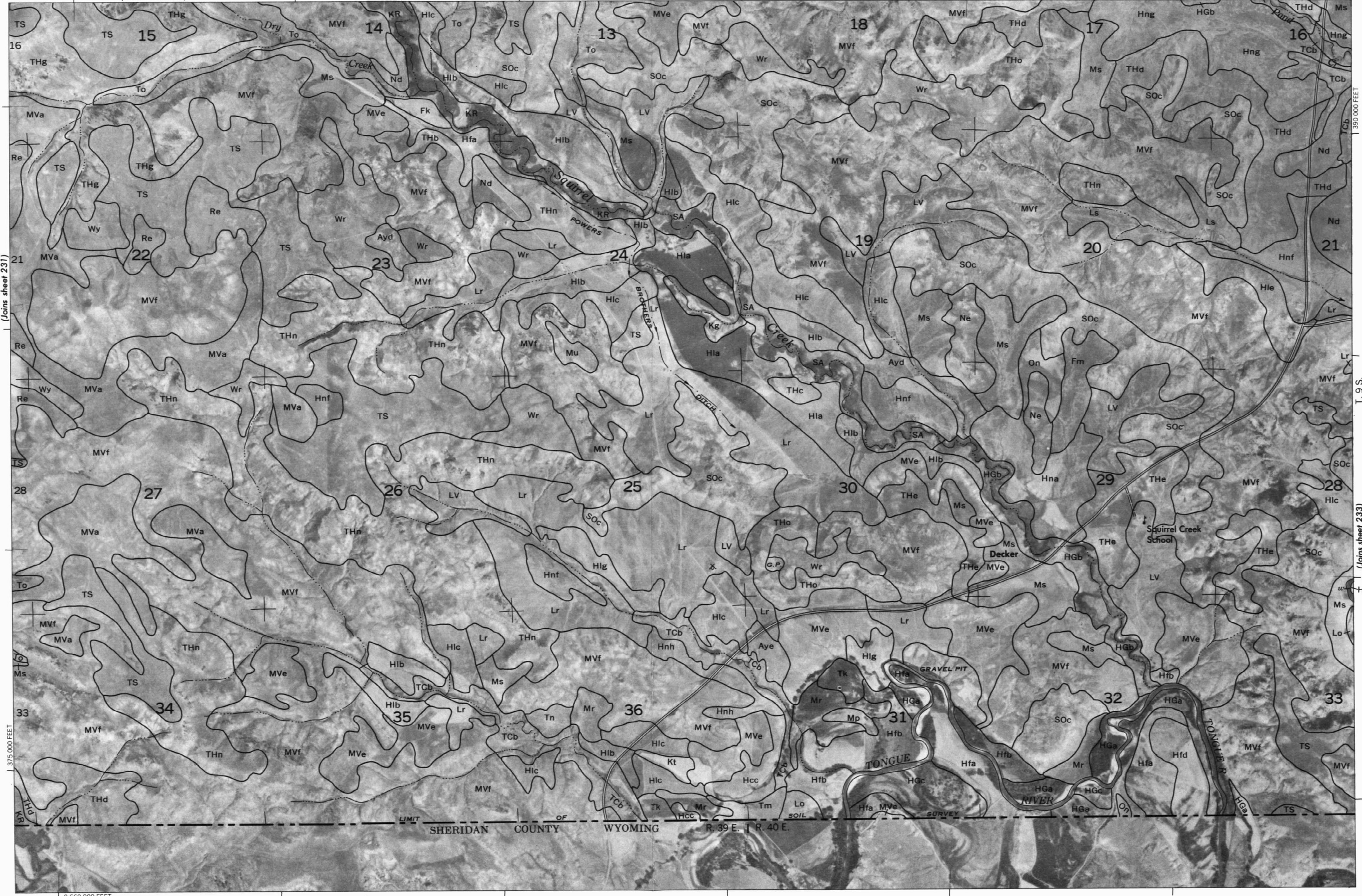
(Joins sheet 230)

T.10S. | T.9S

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.





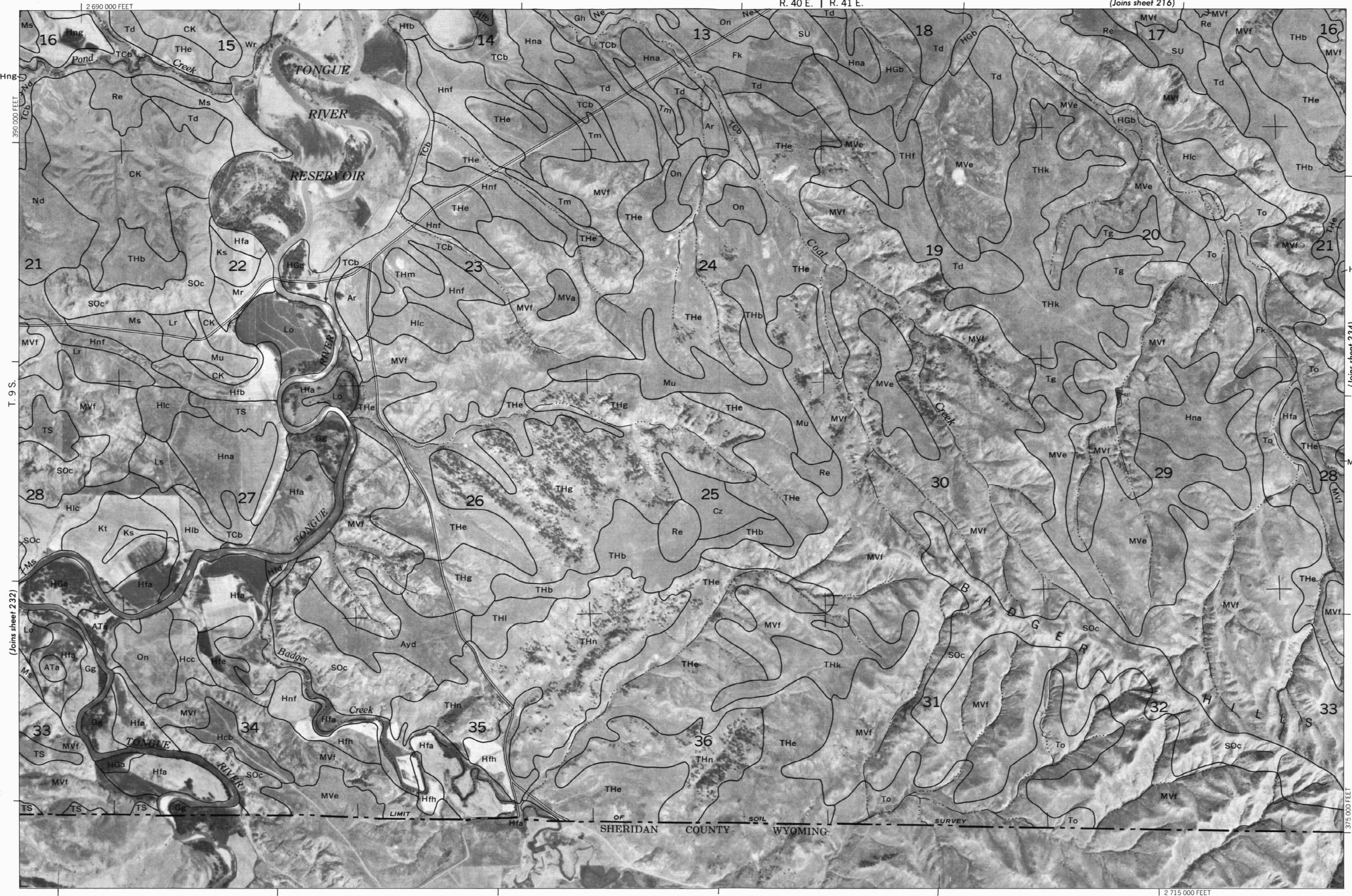


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Coordinate grid ticks and land division corners, if shown, are approximately positioned.



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(Joins sheet 217)



2 Miles

10000 Feet

1

5000

Scale 1:24000

0

0

1000

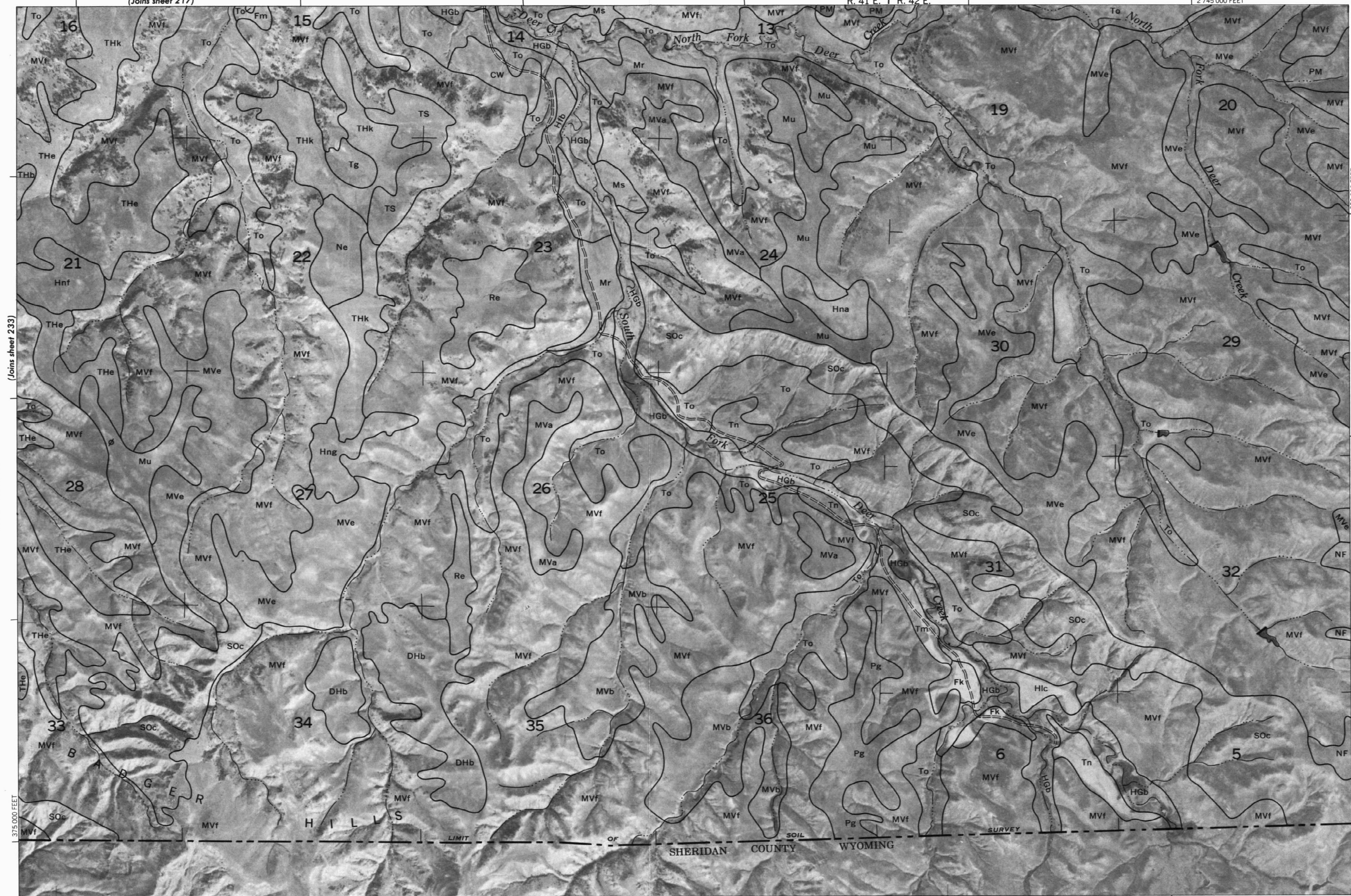
2000

3000

4000

5000

375 000 FEET



390 000 FEET

(Joins sheet 235)

T. 10 S. T. 9 S.

2 720 000 FEET



2 Miles

10000 Feet

Scale 1:24000

Scale 1:24000

BIG HORN COUNTY AREA, MONTANA NO. 235

This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

T. 10 S. | T. 9 S.

(Joins sheet 234)

390 000 FEET

A horizontal scale bar with a vertical tick mark at the right end, labeled "2 750 000 FEET".

2 775 000 FEET





2 Miles

10 000 Feet

1

5 000

0

0

1 000

2 000

3 000

4 000

5 000

1/4

1/2

3/4

1

1/4

1/2

3/4

1

1/4

1/2

3/4

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1

1/4

1/2

3/4

1

1/4

1/2

3/4

1

(Joins sheet 235)

Scale 1:24 000

T. 9 S. 380 000 FEET

T. 10 S.

380 000 FEET

380 000 FEET

380 000 FEET

380 000 FEET

380 000 FEET

380 000 FEET

380 000 FEET

380 000 FEET

380 000 FEET

380 000 FEET

380 000 FEET

380 000 FEET

380 000 FEET

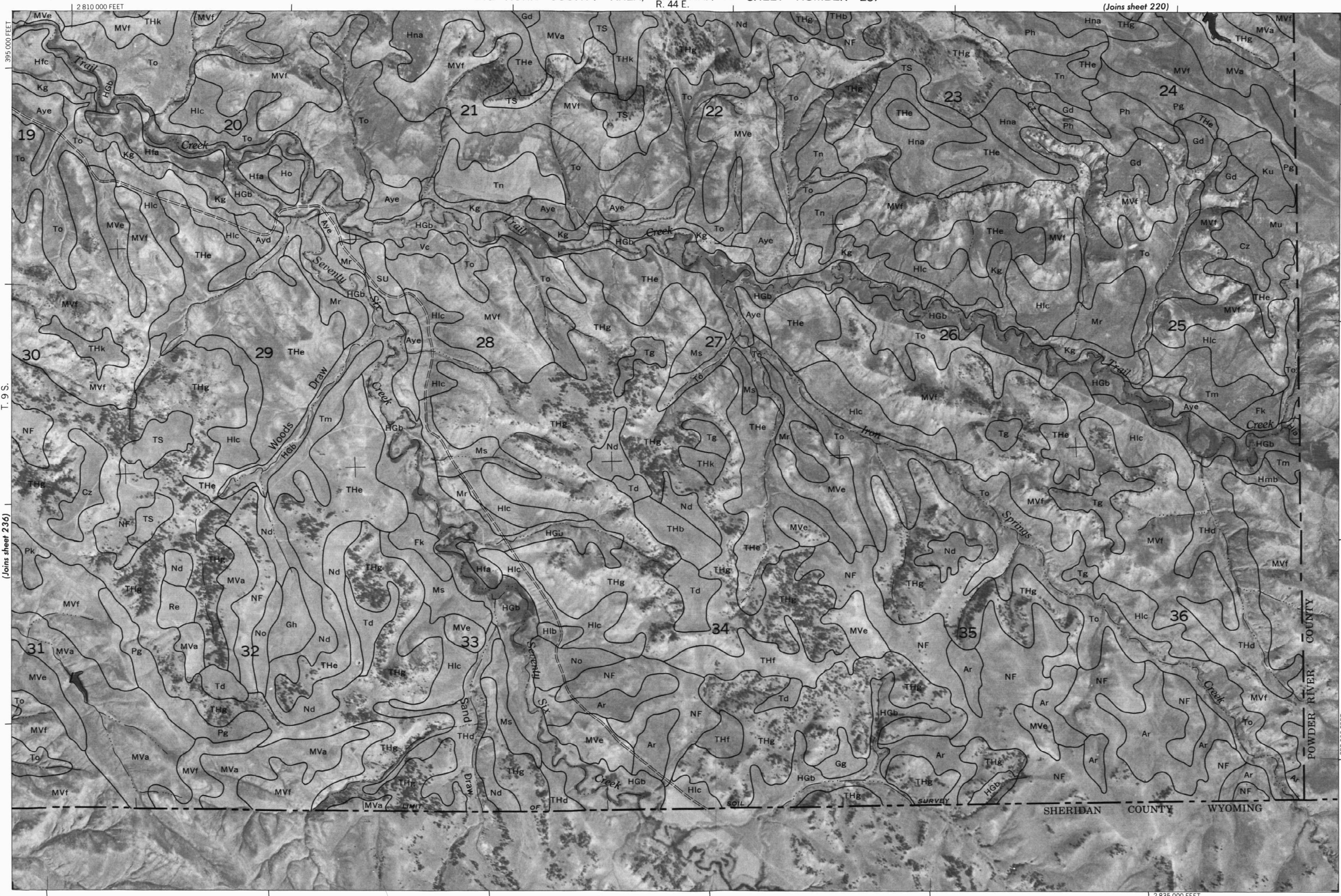
380 000 FEET



(Joins sheet 237)

395 000 FEET





This map is compiled on 1970 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BIG HORN COUNTY AREA, MONTANA NO. 237

T. 9 S.

(Joins sheet 236)